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the OIL AND GAS JOURNAL

MARCH 22, 1954 VOL. 52 NO. 46

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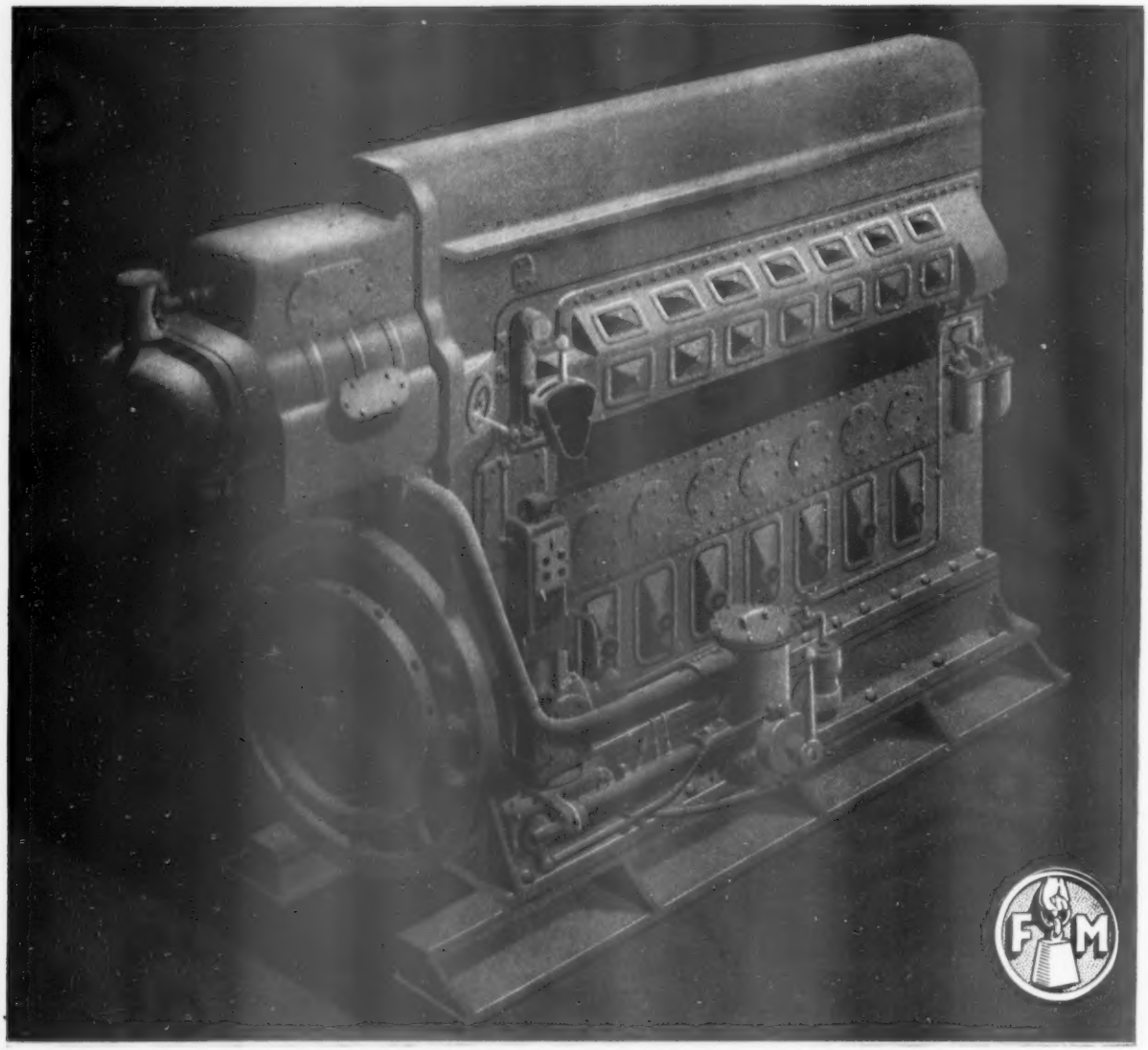
In Brief . . .

The special refining section of this, the annual refining issue, is divided into three parts:

• Seven modern fuel-oil-reduction processes. These processes are designed to meet the residual-fuel problem by converting these unwanted fractions into suitable cat cracker feed stocks and valuable byproducts. Detailed flow sheets and process descriptions are included.

• The residual-fuel problem. The most comprehensive discussion of the bottom-of-the-barrel problem yet compiled is presented in a three-article series by George Weber, refining editor. Weber discusses residuals, asphalt, and coke. In addition there are six other articles written by industry experts on the residual problem.

• Modern refining processes. The Journal's 1954 surveys of refining capacities and processes, and new construction projects is presented in this section. Also included are three other pertinent articles on refining developments.



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Just look at the difference...

Figs. 1 and 2 are representative of results obtained in a test conducted by a major oil company in an area where an abnormal number of sludge complaints in domestic heating systems were received.

Fig. 1 shows a typical filter element as removed from one of the heating units after running on untreated fuel. Fig. 2 shows an element at the end of a 90-day test period in which the same fuel plus Fuel Oil Additive No. 2 had been used in the system.

This, and other findings in the test, indicated that Du Pont Fuel Oil Additive No. 2 acts as an active sludge dispersant in concentrations of 20 lbs./1000 barrels and that its use in dirty fuel oil systems is generally beneficial.

Increase your heating oil market with

DU PONT FUEL OIL ADDITIVE No. 2

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Actual field tests, of which the filter elements illustrated above are a part, show also that Fuel Oil Additive No. 2 acts as a sludge dispersant in dirty fuel systems and, being ashless, burns completely with the fuel.

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and easy operation
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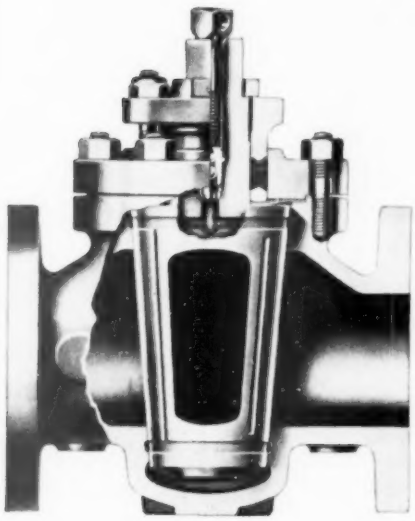

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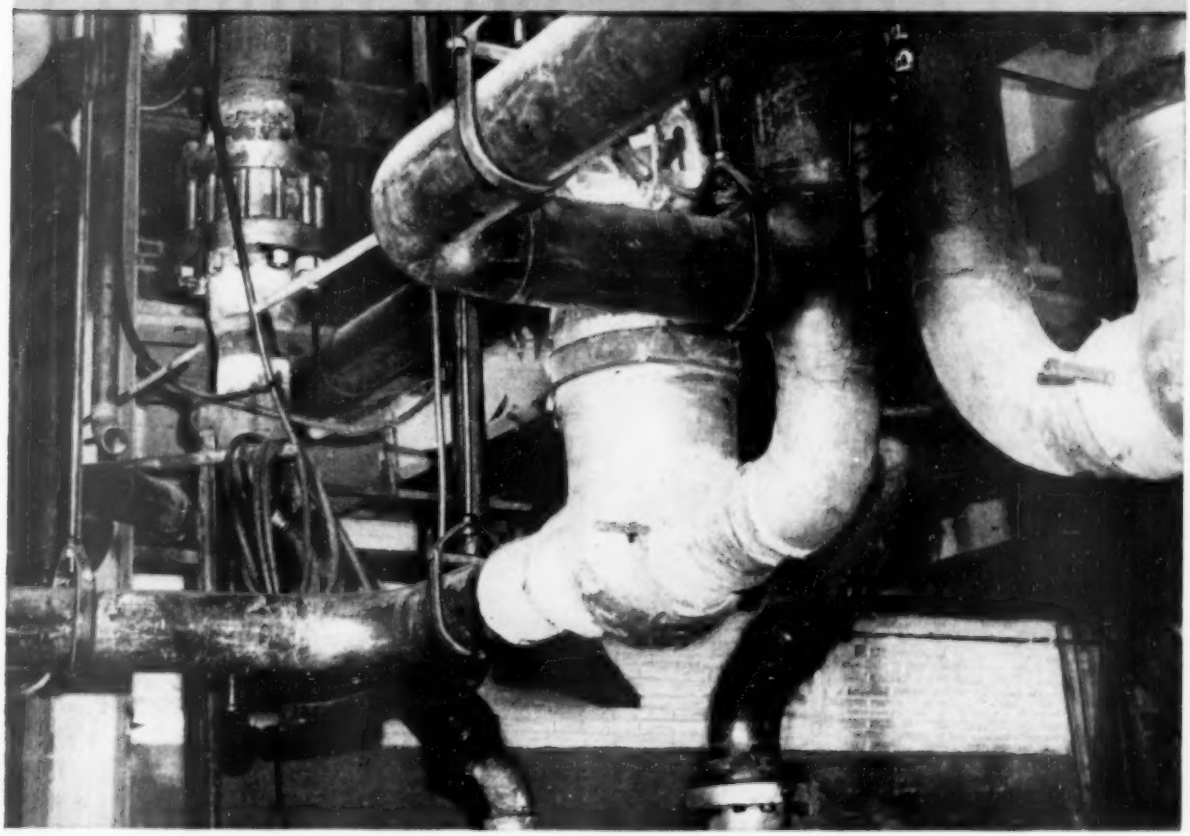

Boiler feed discharge piping shown under construction above will operate at 2700 psi and 430° F.

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exceed bursting strength of seamless pipe

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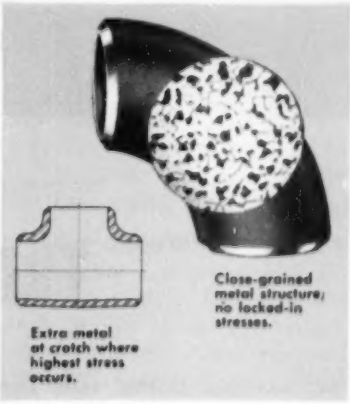
With all Grinnell Welding Fittings, you get true circularity; smooth, clean inside surface; full, effective radius; easy, sweeping turns; accurate bevels; and true included angles. Available in a wide range of types and sizes, metals and alloys. Send for descriptive catalog.



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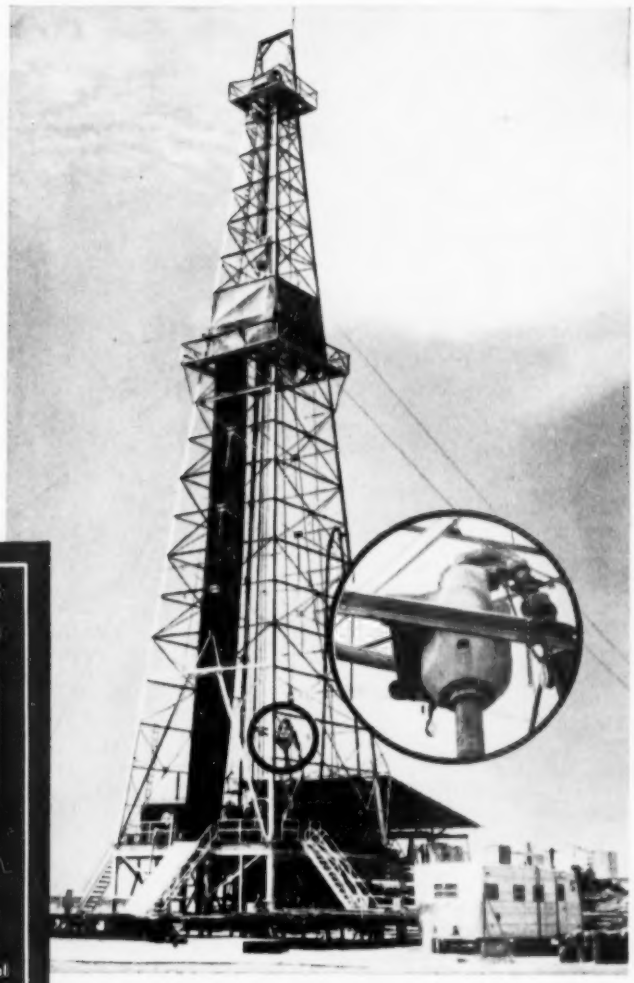
NO ROTARY HOSE OR COUPLING TROUBLES

on this deepest oil well in the Permian Basin



THIS is the rig that drilled the deepest well in the history of the Permian Basin—a 16,696 footer. It is owned and operated by a well-known drilling company. It is equipped with a Goodyear Rotary Hose and Coupling. And throughout the more than three miles of tough going, this rugged hose and integral connection "performed perfectly."

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For more details see the G.T.M. or your Goodyear Distributor. Or write to Goodyear, Industrial Products Division, Akron 16, Ohio.

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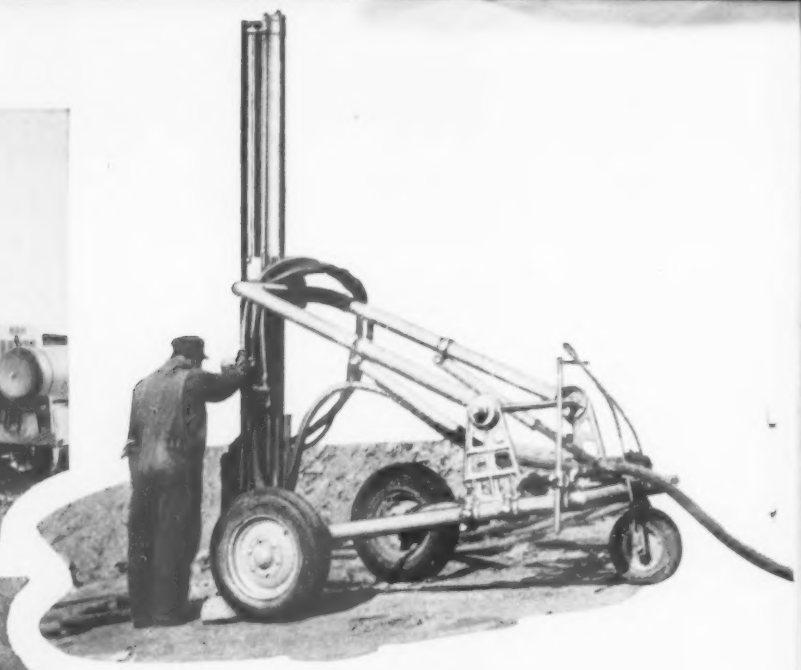

Le Roi-CLEVELAND Clay Digger — at work on a sewer job. Well-balanced for easy handling, these spaders pack plenty of wallop for the stiffest clay. Operators like them, because they can do more work with less effort. A one-piece, bonded, rubber buffer with split steel collars keeps out dirt and grit — makes steel changing faster.

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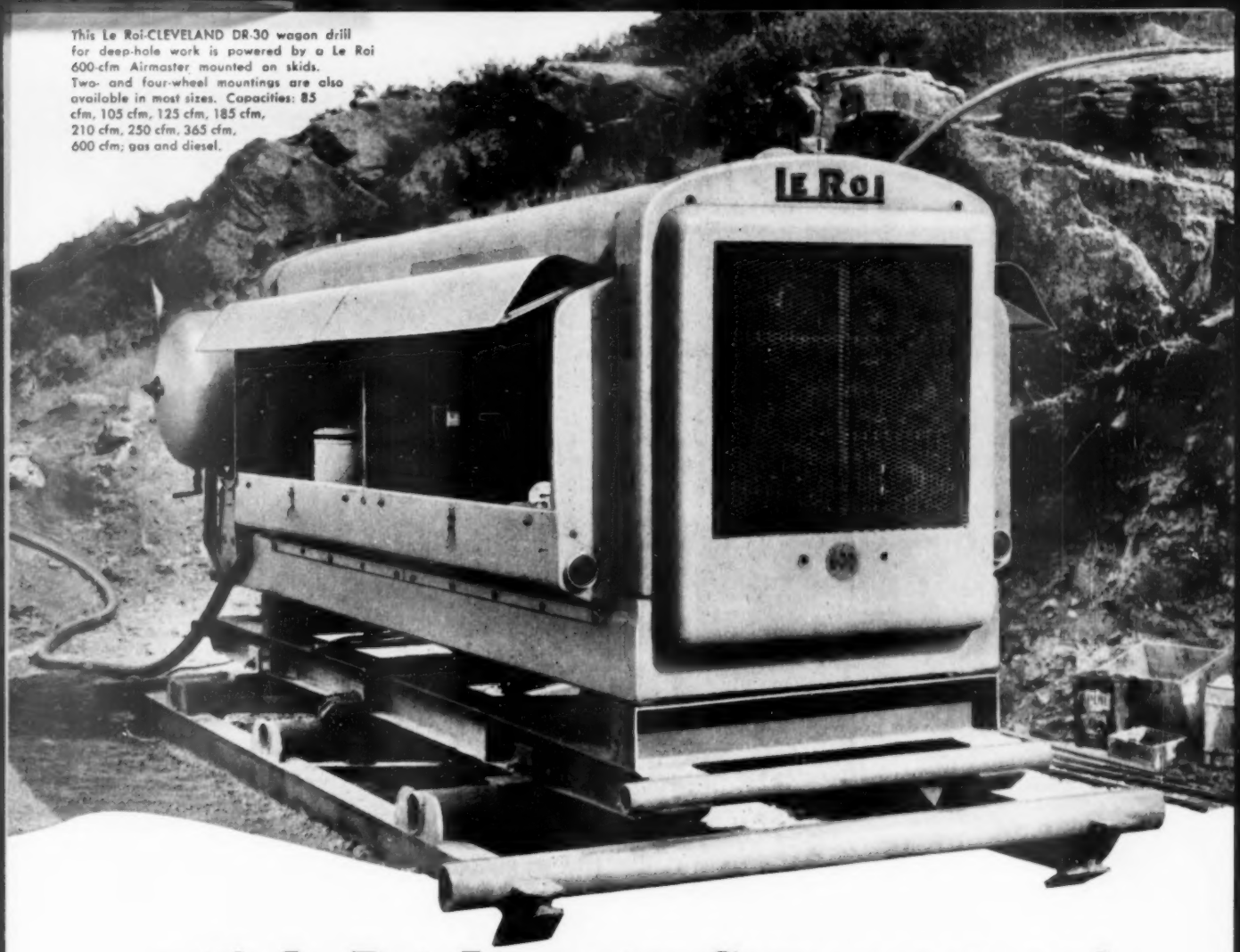

This Le Roi-CLEVELAND DR-30 wagon drill for deep-hole work is powered by a Le Roi 600-cfm Airmaster mounted on skids. Two- and four-wheel mountings are also available in most sizes. Capacities: 85 cfm, 105 cfm, 125 cfm, 185 cfm, 210 cfm, 250 cfm, 365 cfm, 600 cfm; gas and diesel.

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AIR POWER is so widely used, because it does so many things — because it saves money.

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- Le Roi, with 8 sizes and 14 models, offers the widest range of portable-compressor sizes available. Now you can match your job requirements exactly, with an Airmaster Compressor that lets you do the most work for the least cost.
- Le Roi Airmasters are powered by a heavy-duty Le Roi engine designed especially for compressor service. Conservative engine ratings give you ample power reserve — for lower fuel consumption, less maintenance, lower operating costs. Magneto ignition gives you quick, easy starting — saves time, lets you get going faster.

For still better results, still lower costs, use Le Roi-CLEVELAND air tools with your Airmasters. They will drill more rock, dig more clay, break more pavement, tamp more fill for you.

Use this team and you will find, as so many have, that Le Roi gives you more for your money — more air power, more footage, more profits. See your Le Roi distributor or write us for further information.

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No one can buy an extra minute of time, at any price; but you can *save* time from normally uninteresting activities, such as transportation of yourself from place to place.

The time saved can be spent on the things you want to do most. Your family can enjoy more of your company. Your pet charitable activity can profit by more of your attention. Your business can be run more efficiently, with less lost motion. Or, you can even save a little time for relaxation and recreation at your favorite hideaway area.

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FREE **Cut-off Practice Book.** Outlines the quick, easy way to tell when to cut-off and how much. Shows how to obtain maximum service from rotary lines and avoid costly cutting too soon or too late. Carries cut-off tables for derricks of all heights operating in all major oil regions.

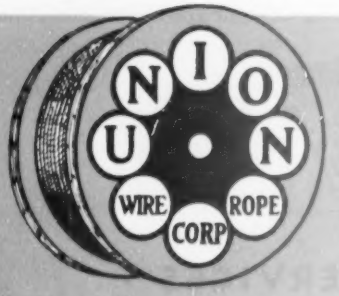
FREE **Handbook of Wire Rope For Well Drilling and Servicing.** More than 40 pages of useful facts on wire rope for rotary, cable tool drilling and well servicing. Includes sizes and constructions of wire rope for all oil field services, its care, lubrication, abuses, correct handling, seizing and socketing.

In Oil Drilling Operations Everywhere toolpushers are increasing the service for rig owners with Tuffy Rotary Line! They've found that Union Wire Rope engineers have developed a rope that can take the tough, different kind of wear that rotary drilling gives!

Tuffy is Made of high carbon steel especially patented and drawn for ultimate service. The wires are pre-shaped around an independent wire rope core—number and size of wires, lay of rope are scientifically formed into a wire rope construction that beats any ever before developed for use on rotary rigs! The result is a rope that consistently gives *extra* ton-miles of service!

Tuffy Standard Rotary Line is especially made for use with standard rigs, or for deeper drilling with jackknife rigs. It spools easily, pays off in longer service before cutting is necessary!

Tuffy Jackknife Rotary Line is an extra-flexible rope, perfect for spooling on the smaller sheaves and drums of jackknife rigs . . . yet there's no loss in strength! Get *all* the ton-miles you pay for by switching to longer-lasting Tuffy Rotary Lines!



UNION WIRE ROPE CORPORATION
2102 Manchester Avenue, Kansas City 26, Missouri

At no obligation, please rush the material I have checked below:

- ☐ Cut-off Practice for Rotary Drilling Book
- ☐ Handbook of Wire Rope for Well Drilling
- ☐ Ton-Mile Indicator and Log Book
- ☐ Put my name on the list for mailings of new Rope Dope Bulletins.

FIRM NAME _____

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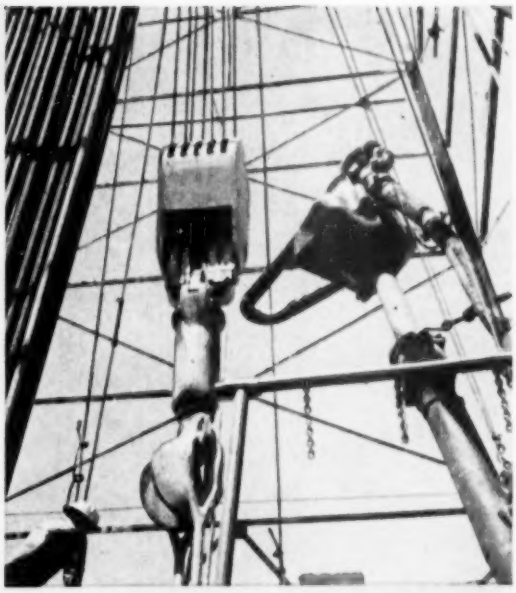
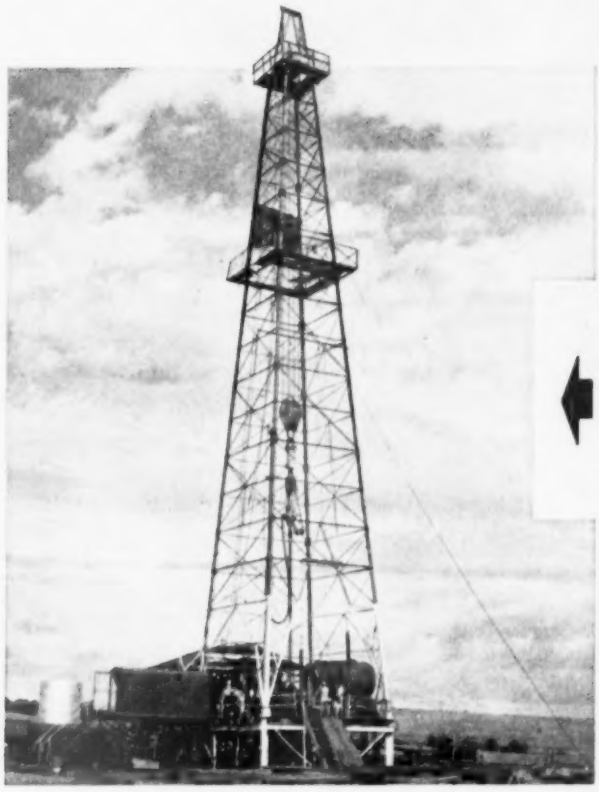
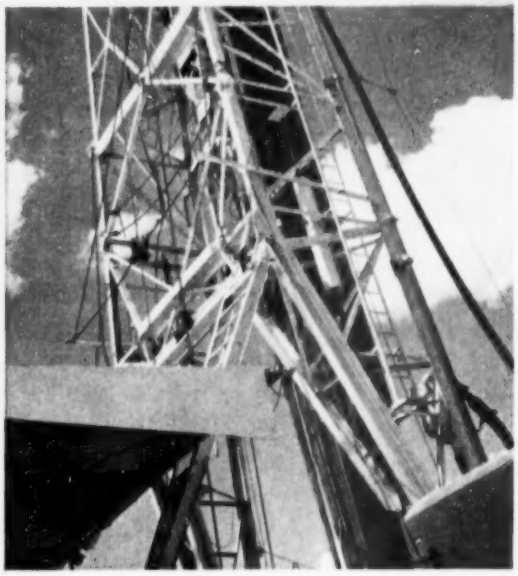
While "Kelly" rests, Tuffy really keeps the job going. Coming out or going in, Tuffy gives you more dependable service because it's constructed just for rotary use! The independent wire rope core, and Union-perfected lay and number of wires used, give you a rotary line that may double the ton-mile service you're now getting!





On wildcat as well as offset drilling operations, look at the many reels of rope in use and chances are you may find Tuffy most often. Drillers are learning that Tuffy consistently pays off in *extra* ton-miles. Toolpushers and rig owners report Tuffy resists drum crushing, shock loads and vibration better than any rope they've ever used!

On jackknife rigs, as on standard rigs, the heaviest wear occurs when you hoist the drill stem to repair or replace the bit. Lifting and stacking the long, heavy string puts tremendous stresses on the rope. That's when the built-in super strength of Tuffy Rotary Line pays off . . . especially with Tuffy Jackknife Line that's extra flexible, too, for best possible spooling and reeving on smaller sheaves and drums!



Tear Off and Mail Coupon On Opposite Page Today!

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Wire Rope
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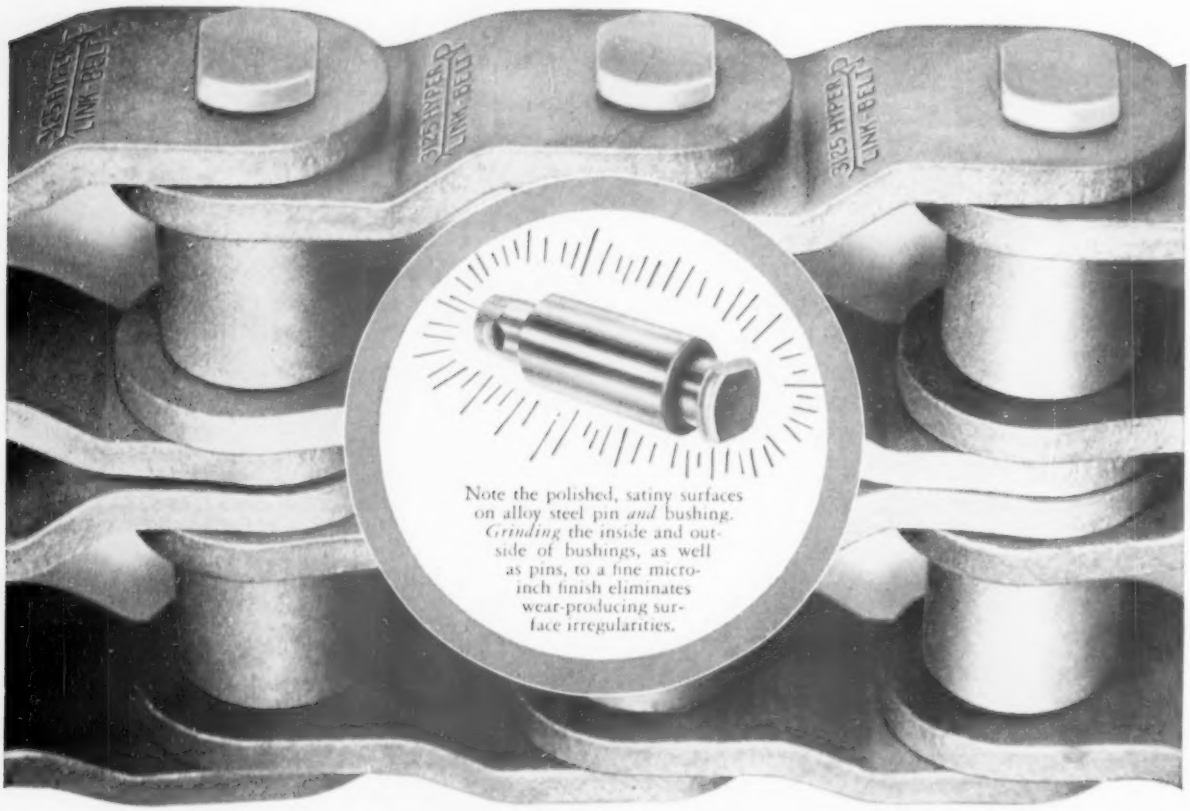
NO SECRET WHY

LINK-BELT API CHAIN leads the field



Note the polished, satiny surfaces on alloy steel pin *and* bushing. *Grinding* the inside and outside of bushings, as well as pins, to a fine micro-inch finish eliminates wear-producing surface irregularities.

LINK-BELT grinds both pins and bushings--gives them a fine micro-inch finish for longer chain life

ENGINEERED and built for today's high speeds and heavy loads—Link-Belt API Chain is the most widely used rotary chain in the field. Drillers all over the world have learned from experience they can rely on this precision chain for their toughest jobs.

In addition to the extra manufacturing steps of *grinding* both pins and bushings to a fine micro-inch finish, Link-Belt maintains the exact control of heat treating and tolerance so necessary to uniformity. And rollers are shot-peened for greater fatigue life.

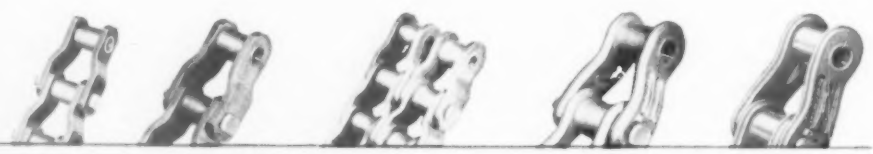
You'll find Link-Belt API in stock at leading supply stores everywhere. Next time you order specify Link-Belt for your best dollar-for-dollar buy.

LINK-BELT

CHAINS and SPROCKETS

LINK-BELT COMPANY: Indianapolis 6, Houston 1, Dallas 1, Los Angeles 33, Scarboro (Toronto 13); Export Office, New York 7. Distributors in All Fields. 12.456

CHOOSE THE RIGHT API CHAIN FROM LINK-BELT'S COMPLETE LINE



SS-40 Hyper A.P.I. 3—For use on all rotary drilling rigs.

SS-3125 A.P.I. 3½—For rotary tables. Multiple-widths also used on heavy hoist and engine drives.

SS-124 3-Bar Hyper A.P.I. 4—For hoists and engine drives.

A.P.I. 4 Super Hyper—For toughest hoists, engine drives.

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All Pacific Valves, regardless of price, are of the highest caliber of workmanship and materials . . . the highest quality attainable!

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Pacific now offers a complete line of Gate, Globe, Check and Angle Valves. Pressure ratings from 150 lb. to 1500 lb., in all popular sizes.

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Each Valve must pass a series of prescribed tests before being certified as a "Pacific" Valve. Your assurance of safety and performance!

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Prompt, efficient deliveries are assured from warehouse stocks. Special orders are expedited through engineering and production without delay.

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Pacific Quality Valves are available at competitive prices for comparable valves. Write or call your nearest representative for prices.

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3201 Walnut Ave., Long Beach 7, California

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Fig. No. 150—6"

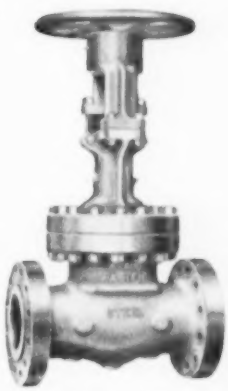

Fig. No. 650—6"

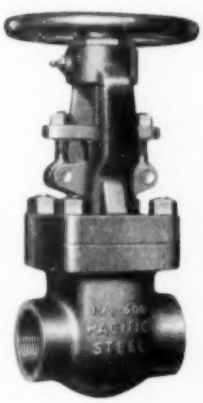

Fig. No. 3651—1¼"

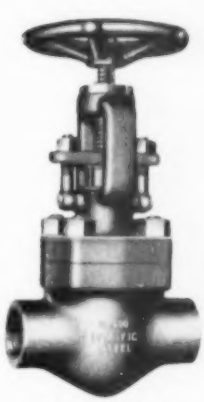

Fig. No. 3661—¼"

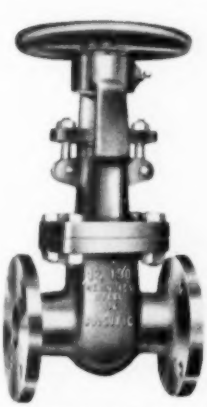

Fig. No. 500—1½"

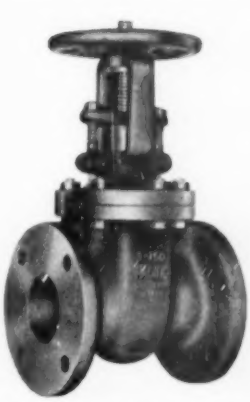

Fig. No. 8550—3"

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ALLOY STEEL WELDING FITTINGS

Substantial Savings for Leading Refinery
PLUS These Other Outstanding KEY-KAST Benefits

1. Delivery of fittings was on *schedule* with the pipe.
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3. Although KEY-KAST fittings were *not* ordered to radiographic quality—all weld ends were gamma rayed and KEY-KAST fittings showed up better than class 2 per ASTM E-71.

GIVE YOUR PIPING SYSTEM THE ADVANTAGES OF KEY-KAST ALLOY STEEL WELDING FITTINGS

- Greater wall thickness throughout with *extra* thickness in critical areas
- Lower unit cost.
- Meet A.S.M.E., A.S.T.M., A.S.A. Codes.
- Rigidly tested and inspected to meet high standards of quality.

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What do you know about Dana?

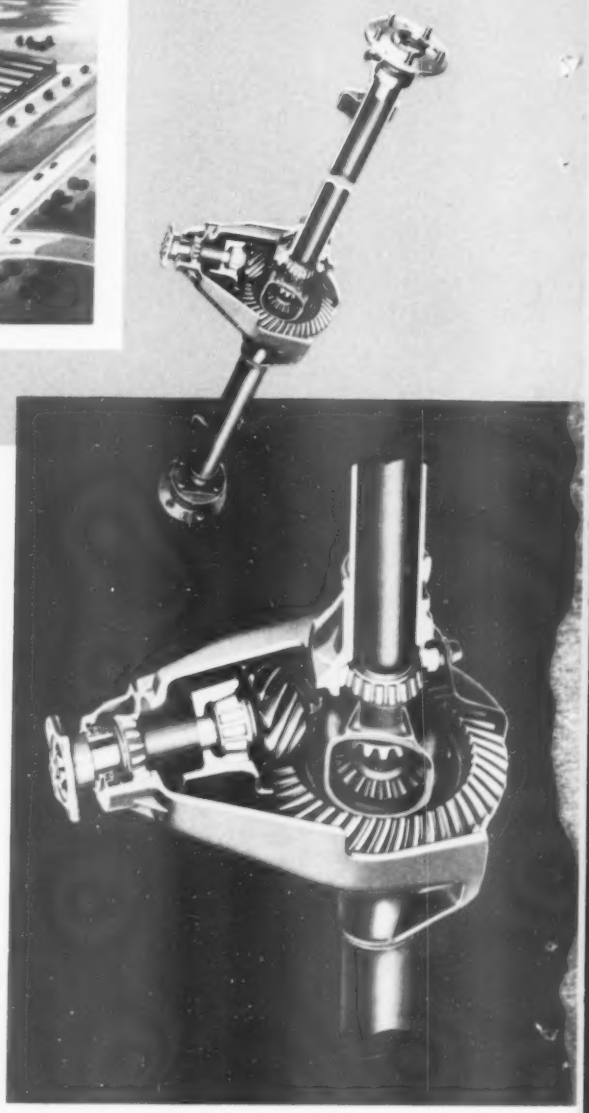
Charles A. Dana

The Dana Corporation comprises a group of industries that is widely diversified in lines of manufacture. Its principal service is to those companies producing passenger cars, trucks, buses and tractors, and other self-propelled vehicles, for civilian and military use. Many Dana products are used in the aircraft industry, and as components in a wide range of machinery and appliances.

The Dana Corporation had its founding in the Spicer Corporation in 1904. This company was formed by Clarence W. Spicer, inventor of the first commercially-produced automotive universal joint. Spicer Joints now are used as standard equipment on a majority of the world's automotive vehicles. Today the Dana Corporation produces in its 10 modern domestic plants, and associated plants in Canada, Great Britain and France, the following products: transmissions, universal joints, propeller shafts, Brown-Lipe and Auburn clutches, forgings, axles, stampings, Spicer Brown-Lipe gear boxes, Parish frames, torque converters, power take-offs, power take-off joints, rail car drives, railway generator drives, aircraft gears, and welded tubing.

THIS IS SPICER IN FORT WAYNE, INDIANA

The Salisbury Axle Division of Dana Corporation is devoted exclusively to the manufacture of the Spicer Salisbury Axle, widely used in automobiles, taxicabs, and light trucks



For nearly 50 years, "SPICER SALISBURY" has meant *quiet axles*

The Spicer Salisbury Axle for passenger car and light commercial use is engineered for long, quiet life. It offers these special features:

RIGIDITY—The special Spicer design and construction maintain accurate alignment of gears and bearings under all speeds and loads. Result: *quiet axles!*

LUBRICATION—Scientifically developed control of oil circulation provides a constant, correctly proportioned flow to all gears and bearings for effective lubrication and cooling. Result: *quiet axles!*

RUGGEDNESS—Sturdily constructed to withstand the high speeds and extremes of punishment which are common in modern automotive vehicle operation. Result: *quiet axles!*

SPICER MANUFACTURING DIVISION
of Dana Corporation • **Toledo 1, Ohio**

50 YEARS OF Spicer SERVICE

TRANSMISSIONS • UNIVERSAL JOINTS • PROPELLER SHAFTS • BROWN-LIPE and AUBURN CLUTCHES • FORGINGS • AXLES • STAMPINGS • SPICER BROWN-LIPE GEAR BOXES • PARISH FRAMES • TORQUE CONVERTERS • POWER TAKE-OFFS • POWER TAKE-OFF JOINTS • RAIL CAR DRIVES • RAILWAY GENERATOR DRIVES • AIRCRAFT GEARS • WELDED TUBING

ENGINEERING
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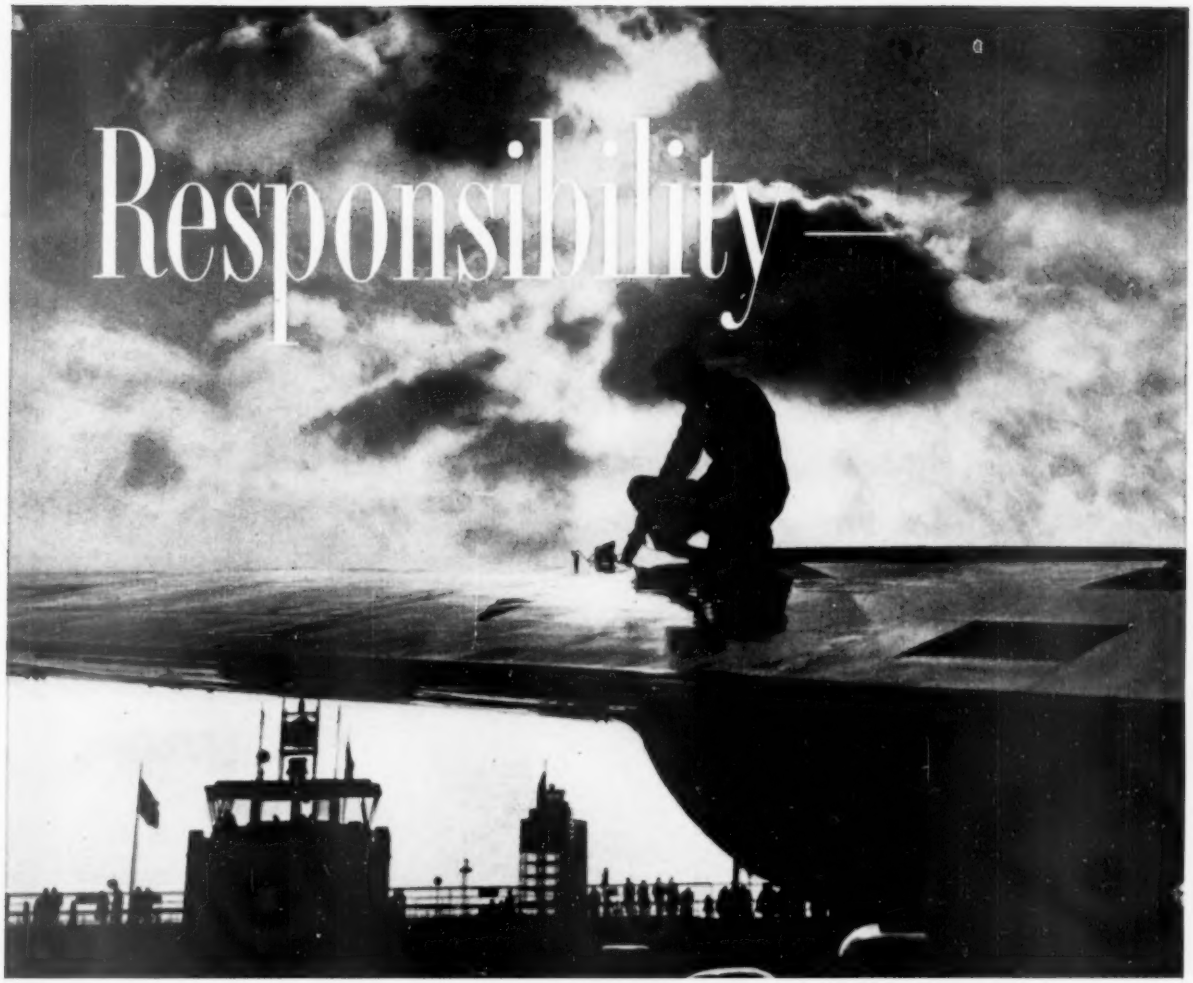

the essential ingredient in any gasoline

Tenamene helps protect the performance of your product

Gasoline has to meet many different specifications and performance standards. It has to function in a wide range of engines over a wide range of operating conditions. Yet, in the normal course of events, no control testing is done by the buyer. Gasoline is bought . . . put to use . . . and its quality is never questioned.

Because quality is "taken for granted," refiners must assume an unusual degree of responsibility. And they do. Gasoline delivered from their pumps is the end product of many carefully controlled processing steps.

One of these steps is the use of additives to prevent gum formation. Here, Eastman helps shoulder some of your responsibility. As a producer of Tenamene inhibiting and sweetening agents, Eastman constantly maintains their high quality and offers the interested service that aids in their proper and economical use. This service includes modern gasoline laboratories and a highly qualified technical staff—ready on short notice—to assist in the solution of refining problems related to Tenamene additives.

For more information contact our local representative or write to Eastman Chemical Products, Inc., Kingsport, Tennessee—a subsidiary of Eastman Kodak Company.

Tenamene

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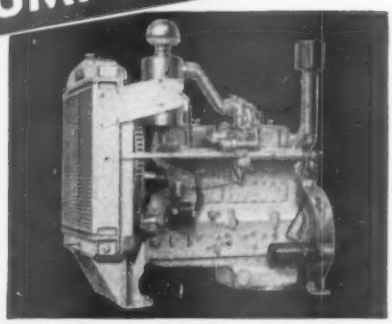

145-GZBU Gas Power Unit—six cylinders, 5⅜-in. bore x 6-in. stroke, 817 cu. in. displ., 176 hp at 2000 rpm on natural gas.

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It gives complete line of Waukesha Oil Field Engines for gas, gasoline, normal Diesel, or turbocharged Diesel operation—to 570 hp.

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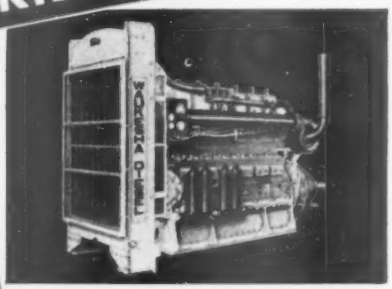
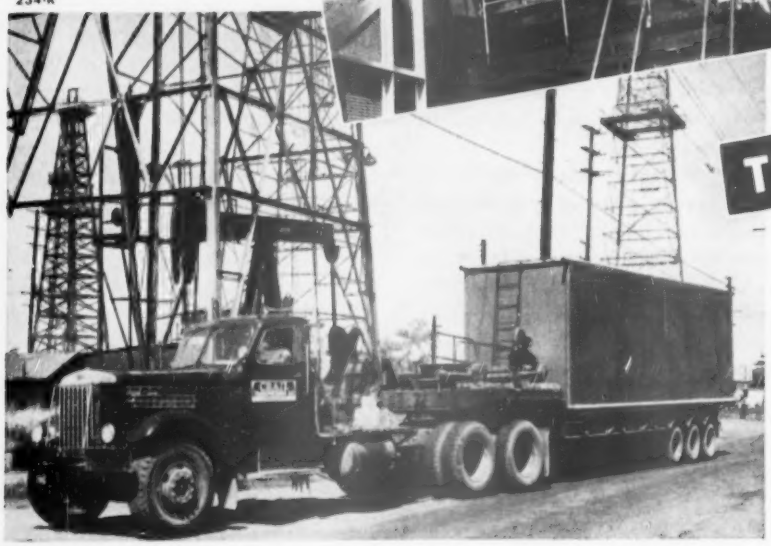
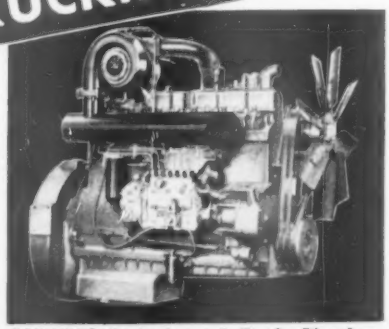
DRILLING



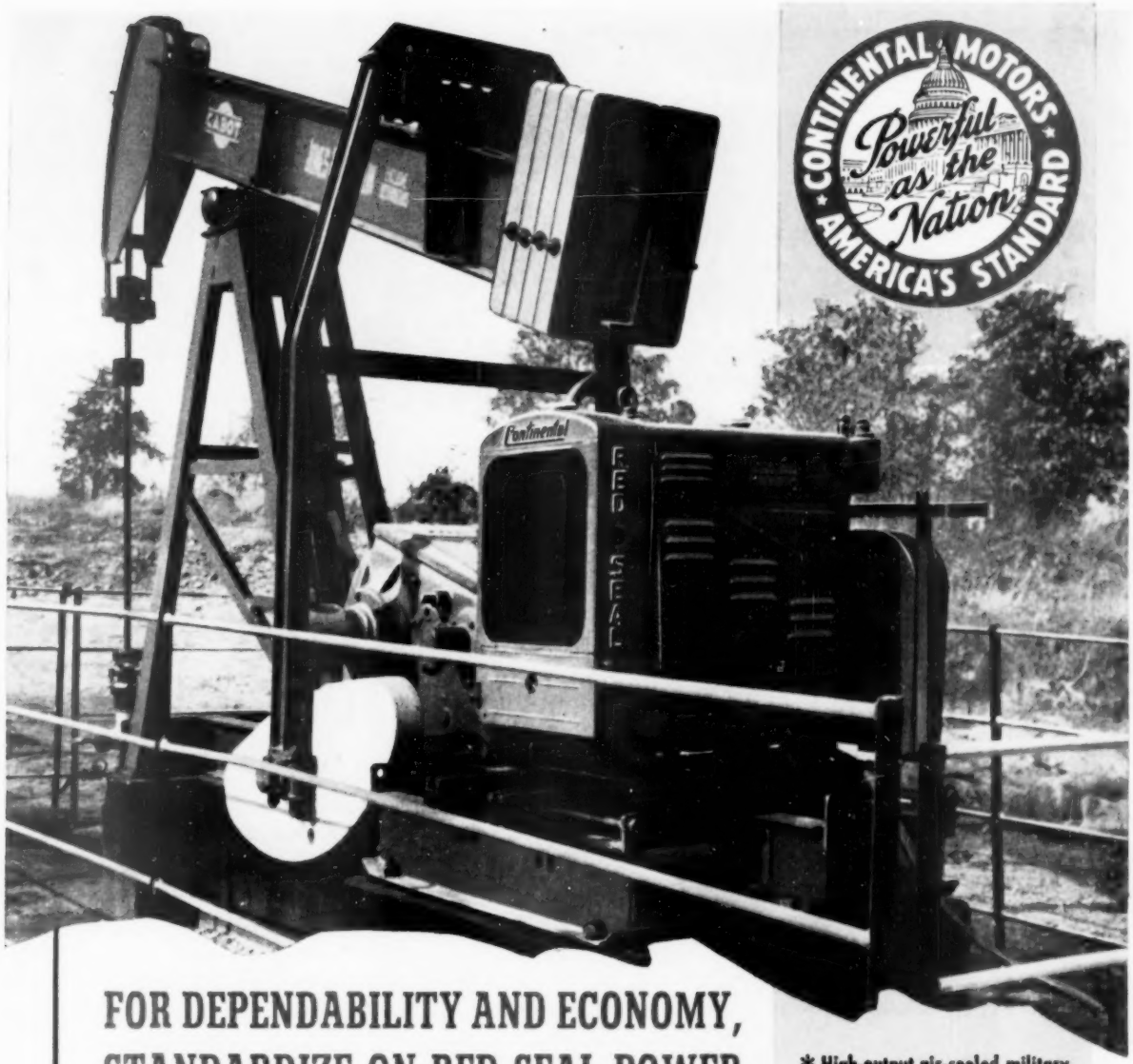
LRDBSU Turbocharged Diesel Unit—six cylinders, 8½-in. bore x 8½-in. stroke, 2894 cu. in. displ., 500 hp at 1200 rpm, max.



TRUCKING



148-DKBS Turbocharged Truck Diesel—six cylinders, 5¼-in. bore x 6-in. stroke, 779 cu. in. displ., 280 hp at 2100 rpm.



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The petroleum industry's widening use of Red Seal engines traces mainly to two factors. One is the broad diversification of the Red Seal line—more than 100 basic models, from 10 h.p. to 1,000-plus*, for use on all standard fuels. The other is Continental's long standing reputation for *dependability*—their inbuilt capacity to *deliver more power, longer, at lower cost.* Ask for them at your supply store.

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*** High-output air-cooled military models developed jointly by Army Ordnance and Continental are now available for commercial applications where high output (375 to 1,000-plus h.p.) low weight, and exceptional compactness are required. For information, address Continental Motors Corporation, Military Division, 76 North Getty Street, Muskegon, Michigan.**

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MUSKEGON, MICHIGAN

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MORE EFFECTIVE... MORE DEPENDABLE

FIRE-STOPPING POWER

MODEL 20-B

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FASTER . . . A short, quick downward motion of the puncture lever pressurizes the extinguisher and it is ready for instant use.

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PROVIDES THE MOST COMPLETE LINE OF DRY CHEMICAL FIRE EXTINGUISHING EQUIPMENT

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NEW WHEELED PORTABLES

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MODEL 350-B

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Ansul Fire Extinguishers are designed for maximum effectiveness even when used by inexperienced employees. They are easy to operate and can be quickly recharged "on-the-spot." No special tools are required for recharging, inspection or maintenance. In addition, all Ansul Equipment is water-tight and corrosion-resistant for longer, trouble-free service.

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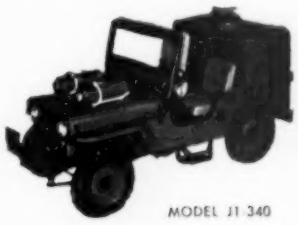
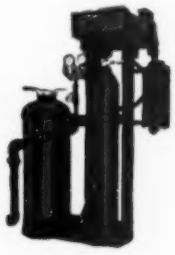


MODEL JI-340

MODEL S-2000-B



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GM DIESEL
CASE HISTORY No. 538-1Y

USER: Cardinal Drilling Company, Bismarck, N. D.

INSTALLATION: Two GM "Twin 6-71" Diesels replaced four gas engines in February 1953, driving PBM 36 Emsco drilling rig and mud pump.

PERFORMANCE: Drilling Superintendent Charles Spaulding reports he's cut fuel costs 49%, cut maintenance costs 25% and boosted production 25% since he switched from butane to GM Diesel power. GM Diesels also eliminated the problem of fuel freezing in the lines when drilling in 30° - 40° below zero weather.

It Pays to STANDARDIZE on

GM
GENERAL MOTORS
DIESEL POWER

Drills Faster—Cut Fuel Costs 49%

Since He Switched from BUTANE to General Motors Diesel

Here's a new General Motors Diesel economy story: Although butane cost this drilling contractor about 5¢ less per gallon than Diesel fuel, he switched from an LP gas engine to General Motors 2-cycle Diesel power—*and cut fuel costs 49%!*

GM Diesels cut fuel consumption by 335 gallons per 24-hour day—boosted production 25%. Because GM Diesels are built for this kind of work, his maintenance costs dropped 25% in the first 8 months. He is also no longer bothered with fuel freezing in the lines.

Producing more power from smaller, lighter Diesel units, quick-starting GM 2-cycle Diesels let drillers make faster moves without special road permits. GM Diesel distributors back up engine performance with fast service and quick delivery of low-cost parts. As Drilling Superintendent Charles Spaulding says, "I'm usually drilling in pretty isolated territory but no matter where I drill, I'm close to GM Diesel service." For more information see your GM Diesel distributor or write:

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HOUSTON, TEXAS. Recently put into operation here for the Sinclair Refining Company is this 35,000 barrel-per-day crude distillation unit, designed and constructed by Fluor. The project also includes a vacuum unit to process bottoms from the West Texas crude still, and a desalting unit for crude being run on existing facilities. Construction began in May, 1952, and seventeen months later was completed on schedule and for less than the estimated cost – in spite of a three-month delay in steel procurement encountered during the 1952 steel strike. Products are propane, butane, pentane, gasoline, distillates, lubricating oil distillates and asphalt. Consult Fluor for engineering and construction services when limitations of time and costs are an important factor.

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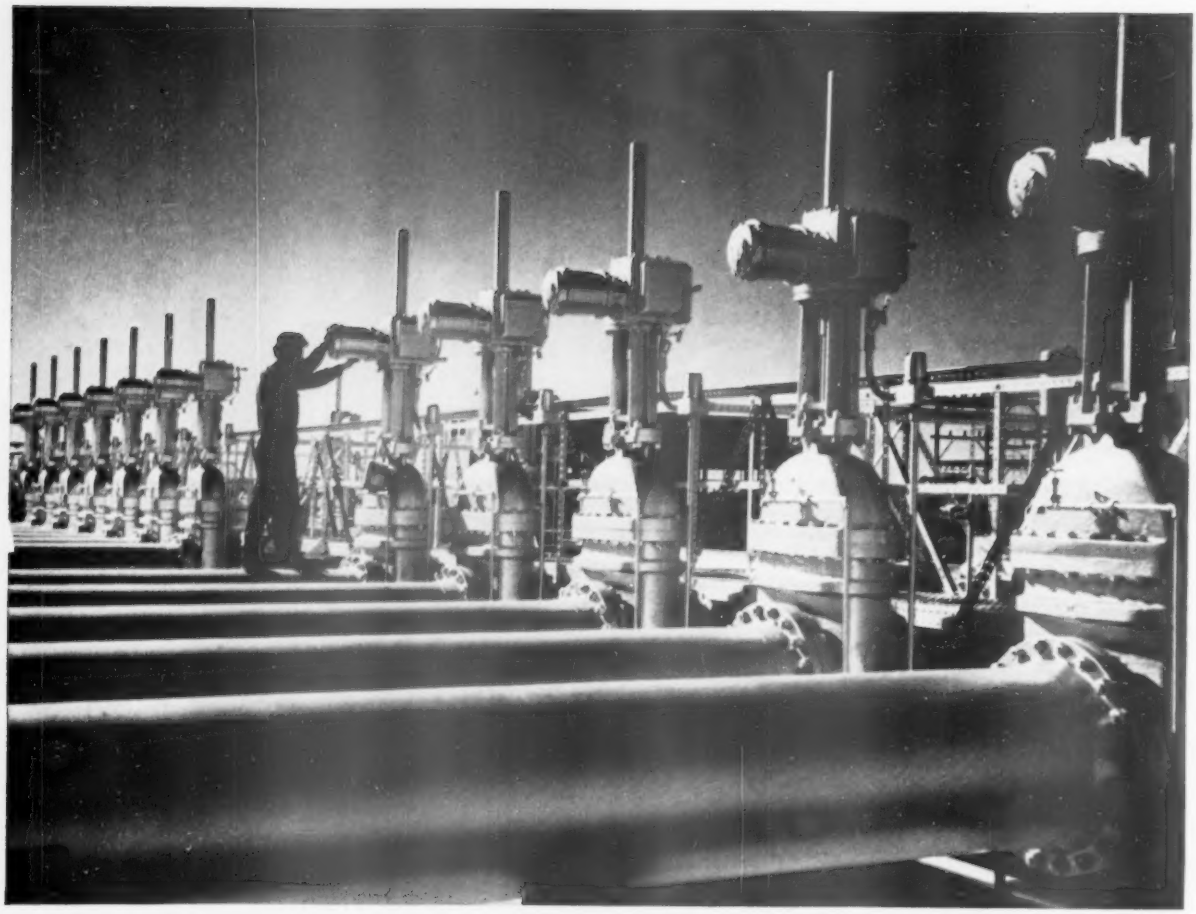

like sentinels on continuous duty day and night

Limitorque® push button valve operators

Opening and closing thousands of valves, by the mere "push of a button", on a majority of the high pressure oil and gas lines throughout the World, *LimiTorque* has proven *dependable, positive* and *safe* under all operating conditions. *LimiTorque saves time and money wherever installed.*

LimiTorque is truly the reliable and unfaltering "sentinel"—always standing guard, outdoors or indoors—in torrid or frigid zones; dust, dirt or fumes and, numerous *LimiTorque* valve operators are also used in Refineries and Gas Plants, as well as Power Plants, Central Stations, Water Works, and on Ships.

The name *LimiTorque* is synonymous with all that is *desirable* in motorized, remote-control valve operations.

Send for further information.

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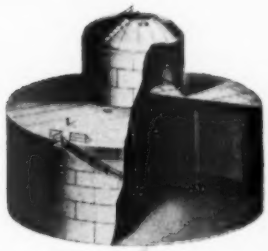
Industrial Gears & Speed Reducers

LimiTorque Valve Controls

the HAMMOND DIALIFT*



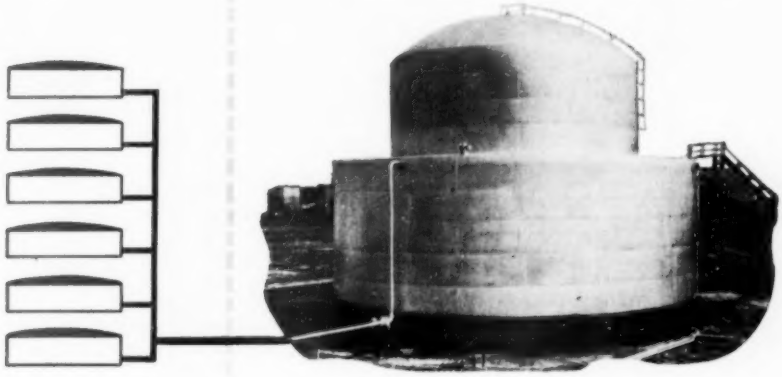
MONEY SAVER FOR PRODUCT-STORAGE OPERATORS!

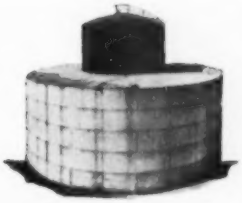
The Hammond DIALIFT is the modern tank for eliminating breathing losses and reducing filling losses. It gives maximum conservation of vapors at lowest cost.

42'6" x 40' Liquid Storage Tank
22' x 17'9" Dialift. Housing — 6500 cu. ft. capacity Inter connected to a 25' x 40' Cone Roof Tank

50' x 48' Liquid Storage Tank
30' x 15'9" Dialift. Housing — 12,500 cu. ft. capacity

The DIALIFT consists of a tubular membrane attached gas-tight to the inside periphery of a cylindrical housing. In operation the DIALIFT functions as the lung of the storage tank. The membrane lifts under a slight pressure when additional vapor storage space is needed, and lowers when less vapor space is required; self-adjusting to the constantly changing breathing conditions within the tank.





80' x 30' Liquid Storage Tank
35' x 17'9" Dialift. Housing — 20,000 cu. ft. capacity

It is easy to convert an existing Cone Roof Tank to an efficient DIALIFT installation. A DIALIFT housing is superimposed on the existing roof, breather holes are installed through the roof plating permitting a free passage for all vapors, no other preparation is necessary.

60' x 48' Ground Type Dialift. 150,000 cu. ft. capacity

*patented

Bulletin 53DL details and describes the Hammond Dialift . . . *Write for your copy.*

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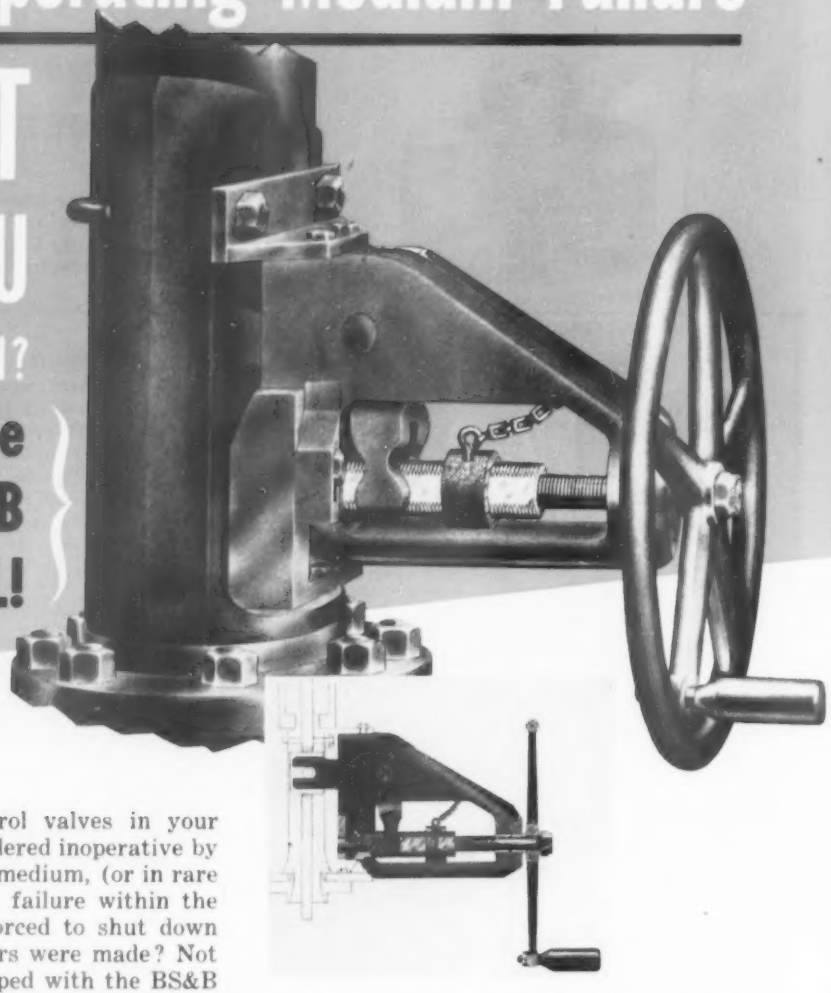
Would an Operating Medium Failure SHUT YOU DOWN?

Not if you have this BS&B MANUAL CONTROL!



If the diaphragm control valves in your plant were suddenly rendered inoperative by failure of the operating medium, (or in rare instances by diaphragm failure within the valve), would you be forced to shut down immediately while repairs were made? Not if your valves are equipped with the BS&B Type Y Continuously Connected Side Handwheel for emergency manual control!

The Type Y is especially designed for use with all BS&B Diaphragm Control Valves, including Types 15 and 86, and the pressure balanced Type 73, where no by-pass is provided around the valve. It has a cast iron frame which fits onto the various Climax Valve Yokes. Working parts are of stainless steel, and it is equipped with an Ampcoloy jack screw, "Oilite" bearings and a large handwheel for ease of operation.

With the Type Y, control valves can be manually positioned in either direction independently of the normal controlling impulses. Its mechanism provides stops so that travel can be set to cover any portion of the complete valve stroke.

Avoid costly shut-downs due to operating medium or diaphragm failure! You can keep your plant operating indefinitely on an emergency basis if your control valves are equipped with the BS&B Type Y Continuously Connected Side Handwheel!

For complete information on any BS&B Climax Control or accessory, ask your BS&B Man, or write to . . .

CLIMAX BS&B CONTROLS OVER 60 YEARS

BLACK, SIVALLS & BRYSON, INC.
CLIMAX CONTROLS DIVISION, DEPT. 4-A3
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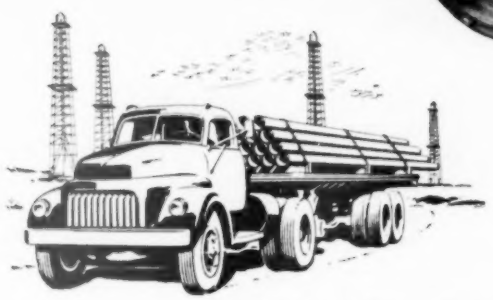
Exclusive Eaton Features add up to Longer Axle Life, Rugged Dependability, Minimum Shop Time, Lower Maintenance Cost



More than two million Eaton Axles in trucks today. For complete information, see your truck dealer.

Eaton's planetary gearing distributes pressure and wear over a number of small gears, resulting in lower unit stress. Forced-flow oiling system provides positive lubrication to all moving axle parts at slowest vehicle speeds. Extra heavy construction eliminates the possibility of distortion or misalignment under full loads. Practical, down-to-earth design makes maintenance quick, easy, economical. Simple shifting makes it easy for drivers to use all available gear ratios. The right ratio for every road and load condition; gives extra maneuverability, positive control at all times. The result of these Eaton features is long, trouble-free axle life, greatest possible vehicle utility at lowest possible cost.

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Axle Division
EATON MANUFACTURING COMPANY
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Explosion-Proof! Dust-Tight! Rain-Tight!

CIRCUIT BREAKER, MOTOR STARTER and COMBINATION MOTOR STARTER

UNILETS

REG. U.S. PAT. OFF.

Illustration shows the high safety factor, versatility, and space-saving attributes of *Appleton* explosion-proof circuit breaker and motor starter *Unilet* Combinations. Your own installation needs, no matter what they may be, can also be met with these remarkable new Unilets.

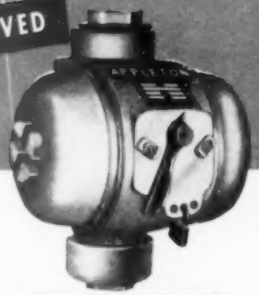
BREAKER LOCKED IN "OFF" POSITION

MOTOR STARTER NO. 5 . . . EXPOSED FOR SAFE MAINTENANCE . . .

but no "down time" on other operating equipment

SAFE ENTRANCE TO MOTOR STARTER WITHOUT DISCONNECTING OTHER BRANCH CIRCUITS . . . ONLY *APPLETON UNILETS* HAVE THIS FEATURE!

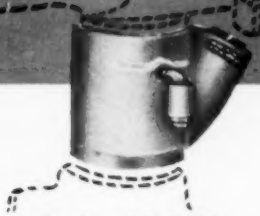
U. L. APPROVED



"CB" Circuit Breaker UNILETS

Assure easy, safe, flexible, and economical installation for protection of service entrance, feeder or lighting, appliance, and branch circuit conductors up to 225 amperes. U. L. Approved individually and in banked groups up to three for forms 1 and 2 without using dividing seal.

U. L. APPROVED



Sealing UNILETS

Available for use as explosion-proof seal where needed on circuit breaker and motor starter Unilets. This Sealing Unilet is furnished on all Combination Motor Starters, and when properly sealed permits safe entrance to a motor starter in single or banked combination installations, without disconnecting other branch circuits.

U. L. APPROVED

"LS" Motor Starter UNILETS

For 3-phase induction motor control up to 100 H.P. at 600 volts maximum. Lightweight construction of larger sizes eliminates need for heavy lift equipment . . . assures easy, time-saving, inexpensive installation. Also made for reversing and two-speed motors.

The greatest advance in explosion-proof design in years!

● You expect more from *Appleton,* and you get it! The proof lies in these completely new and different *Appleton* circuit breaker and motor starter *Unilets.* Alone or in combination, their design, construction, and performance give you maximum safety, unparalleled ease of wiring, installation and maintenance, and initial and long-term money savings not available with any other equipment! You'll find their exclusive features invaluable on any hazardous-location motor control or power lead-in installation, large or small, indoors or outdoors, where tricky wiring, corrosive and flammable atmospheres, dust, or weather difficulties appear insurmountable. Where absolute safety is required day in and day out and every minute of the day, you can place complete confidence in *Appleton Unilets.*

IMPORTANT ADVANTAGES

- **FIRST to be U. L. Approved for BANKED Circuit Breaker Grouping**
- **Combinations Meet U. L. Requirements through Approval of Components**
- **FIRST to Achieve Safe Entrance to Motor Starter of a Combination without Shutting Off Other Branch Circuits**
- **Full 7-Thread Explosion-Proof Protection . . . No Bolts to Strip or Flanges to Nick**
- **Unmatched Accessability for Easiest Wiring and Servicing on Every Job**
- **Light-Weight Construction for Easy Installation without Heavy Lift Equipment**
- **Quick Interchange on All Leading Makes of Circuit Breakers and Motor Starters**
- **Flexible Field Set-ups Assured with Single and Duplex Male and Female Hub Adapters**

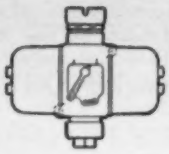
BANKED CIRCUIT BREAKER GROUPING

Male to female hubs permit easy grouping. Cuts costs, streamlines panel set-ups, assures coordinated control without sacrificing safety. U. L. Approved up to groups of three in smaller size Unilets.

VERTICAL "STRAIGHT-THRU" DESIGN

Simplifies wire pulling, saves time. Ample working space eliminates need to remove breaker mechanism from enclosure, yet assures clean, safe wiring.

Patent Applied For



OVER-SIZE CONDUIT and CONDUCTORS

May be run with hub adapters for subsequent installation of higher rated breakers without replacing complete Unilet or existing conduit.

PUSH-BUTTON and PILOT DUTY CONTROL

Combines convenience and selectivity including built-in "Start-Stop," "Hand-Off-Auto.", or "Jog-Run-Off" control where needed.

Sold Nationally Through Electrical Wholesalers

APPLETON ELECTRIC PRODUCTS

APPLETON ELECTRIC COMPANY

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"ST" Liquid-Tight Connectors

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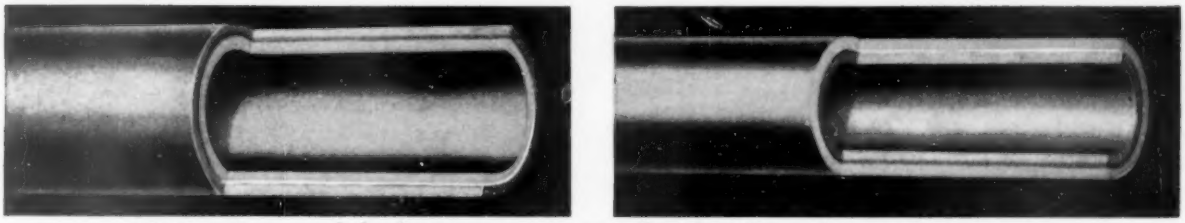
These advantages of Atlantic Catforming are being demonstrated again and again in different commercial installations. We invite you to share in the benefits of Catforming. Please phone, write or wire for our detailed brochure, "CATFORMING." The Atlantic Refining Company, Research and Development Dept., P. O. Box 8138, Philadelphia, Pa.

ATLANTIC

It's the Catalyst that counts

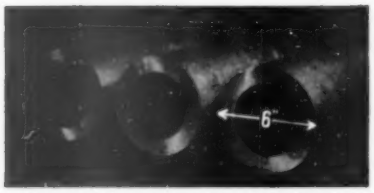
SAMPLE ANACONDA DUPLEX TUBE with a ferrule attached.



DUPLEX TUBES are made by drawing copper or copper alloy tube either *inside* or *outside* of steel tube.

Special purpose ANACONDA® Duplex Tubes

Can be supplied with ferrules attached



DUPLEX TUBES ARE MADE FOR MANY USES other than heat exchangers. These solved an unusual problem for Taylor Forge & Pipe Works, Gary, Ind. They needed copper tubes 6" O.D. x 4" I.D. x 24' long to carry the 12,000 amps at 12 volts required for the I.D. nickel plating of large steel pipe. The copper tube would weigh close to 1500 pounds which exceeded the weight of commercial size tube billets. However, we were able to meet our customer's requirements economically by furnishing ANACONDA Duplex Copper Tubes.

TODAY Duplex Tubes are being used more than ever to meet situations where corrosive conditions on the inside and outside of a tube are different. Other advantages: less maintenance and fewer shutdowns; better heat transfer; better resistance to treated and untreated waters.

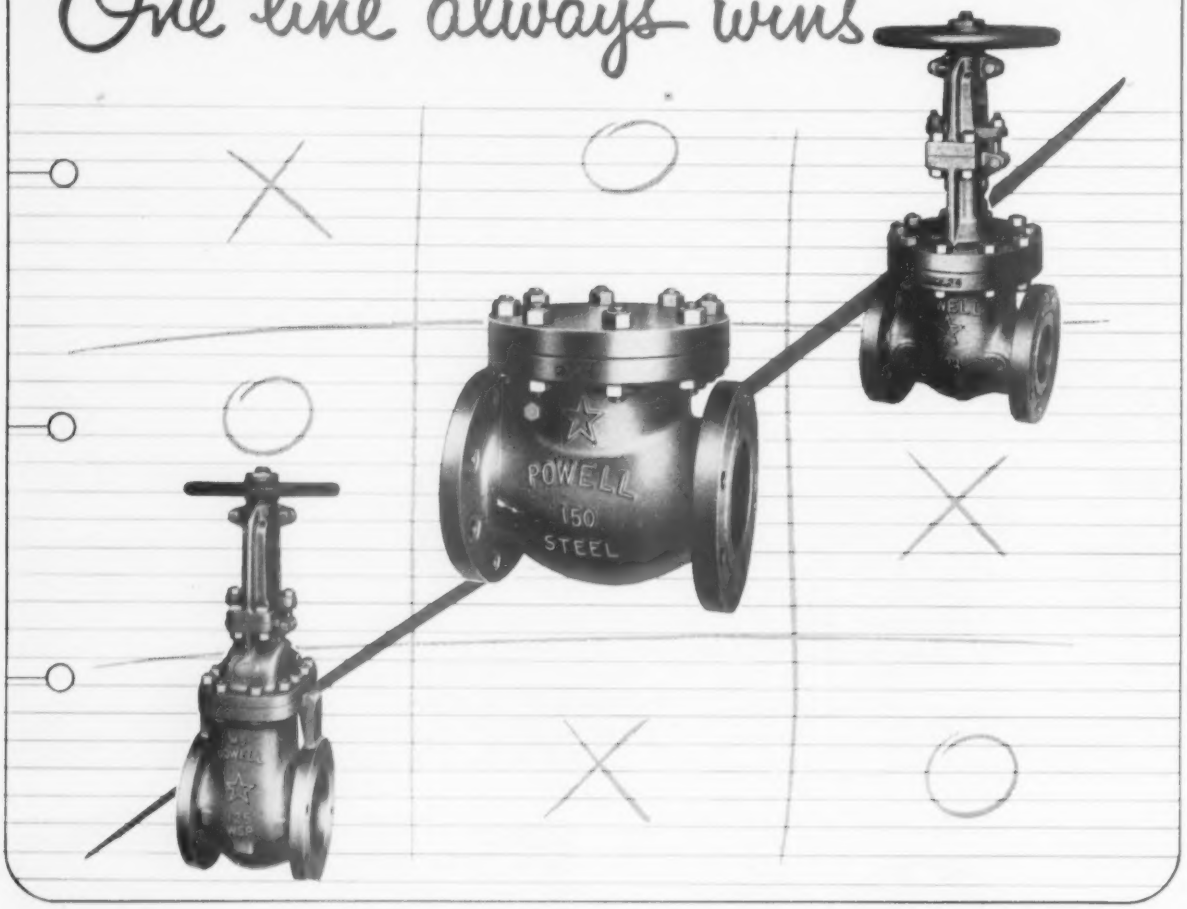
Double-walled ANACONDA Duplex Tubes are available in a wide range of sizes, gages and alloys. They can be supplied with the external tube cut back to receive ferrules for rolling into the tube sheet—also with ferrules attached. The nonferrous tube may be drawn either inside or outside the steel tube. Duplex Tubes can also be made from two different nonferrous alloys.

Duplex Tubes may well be the answer to your dual-corrosion problem. Write to our Technical Department outlining your requirements. They'll be glad to put their experience to work for you. *The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.*

ANACONDA®

Tubes and Plates for Condensers and Heat Exchangers

One line always wins



TOP

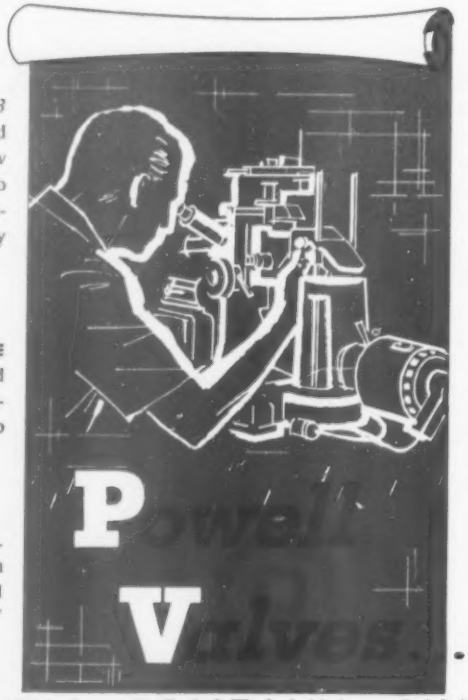
CAST STEEL GATE VALVE *(Fig. 3003 FE)* for 300 pounds W.S.P. Bolted flanged bonnet with outside screw rising stem and yoke. Sizes 1" to 24", inclusive. In addition to Carbon Steel, also available in Alloy Steels.

CENTER

CAST STEEL SWING CHECK VALVE *(Fig. 1561)*. 150 pounds. Bolted flanged cap. Heavy rugged construction. Available in sizes ¾" to 18", inclusive.

BOTTOM

"MODEL STAR" GATE VALVE *(Fig. 1793)* for 125 pounds W.P. Iron body, bronze mounted. Supplied with taper solid wedge. Sizes 2" to 30", inclusive.



There's never any doubt about what tack to take in choosing the winning line of valves. It's Powell! For Powell Valves are manufactured up to The William Powell Company standards of quality—standards that have kept rising for more than a century.

What's more, Powell has a *complete line*—probably manufacturing more types of valves than any other organization in the world.

Powell Valves are available through distributors in principal cities. If a distributor is not located near you, just write us. We'll be pleased to tell you about our complete line and answer your questions. Answering questions is a specialty at Powell where solving valve problems has built the world's most valuable background of sound solutions.

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petrochemical processes

Foster Wheeler has been actively associated with both the petroleum and chemical industries for over 30 years and has designed and constructed many individual petrochemical process units as well as complete chemical plants.

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the FOSTER WHEELER process for -

ammonia synthesis

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Two Ammonia producing plants recently placed "on stream" and four more are in various stages of design and construction. These six plants have a rated capacity of **1000 Tons per day.**

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Vickers Model JV-20400-A
20 ft stroke length
7 strokes per minute
35,000 lb polished rod
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Also available in 30-foot stroke

The Most for Your Money...

per foot of polished rod
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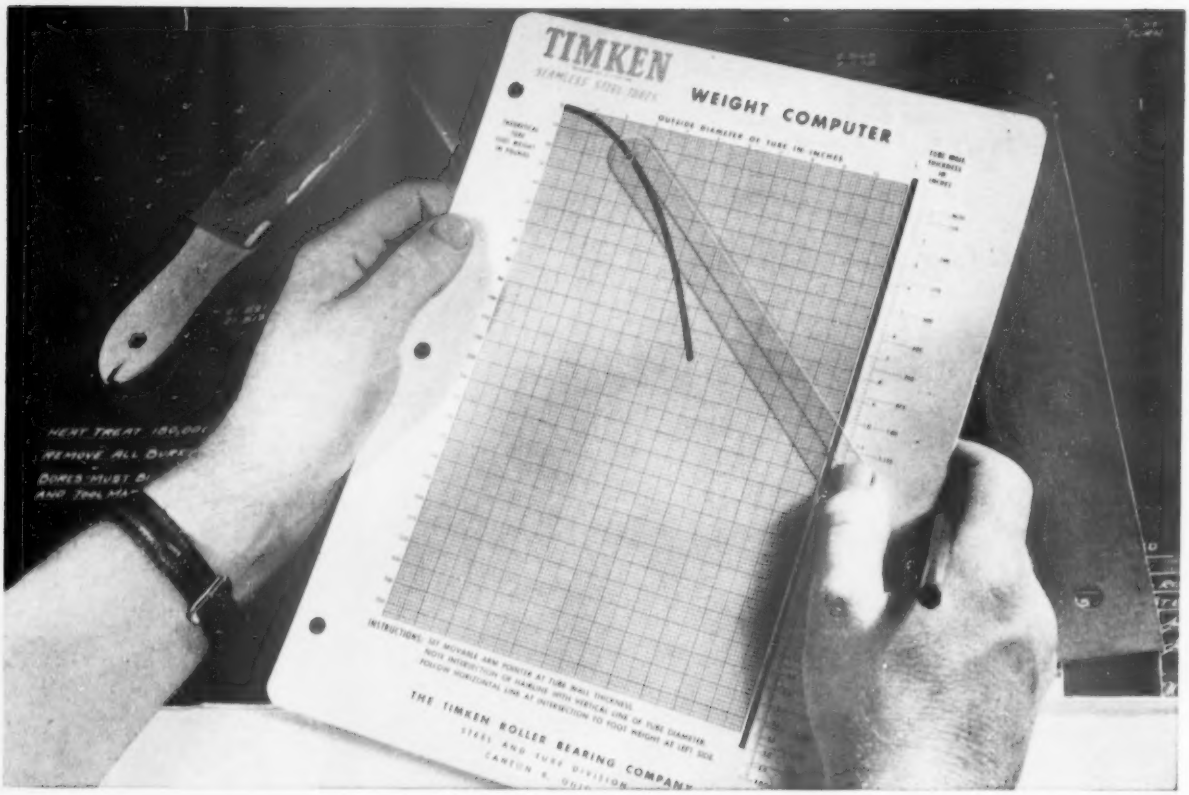

This free computer quickly figures the weight of steel tubing

WITH this handy little computer, you can quickly figure the weight of steel tubing. You set the slide at tube-wall thickness and O.D. and simply read off the tube weight per foot. Write us and we'll send you one. There's no obligation, of course.

This computer is a small example of the helpful service the Timken Company offers manufacturers of hollow steel parts. Even more important: our engineers will be glad to study your problem and recommend the most economical tube size, *guaranteed* to clean up to your dimensions.

Many companies that formerly used bar stock for their hollow parts are making significant savings because they switched to Timken® seamless tubing. In addition to the big reduction in scrap loss, they save a great deal of machining time. Frequently, finish boring is the first production step. Machine tools are released for other jobs.

Timken seamless tubing has fine forged quality because it is made by a piercing process which is basically a forging operation. Write us now on your company letterhead for the handy tube weight computer. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING

PROCESS EQUIPMENT NEWS

PUBLISHED BY FABRICATED PRODUCTS DIVISION, THE M. W. KELLOGG COMPANY FEB.-MAR. 1954

EXCHANGER DESIGNED FOR HIGH PRESSURE DIFFERENTIAL

A pressure differential of approximately 1300 pounds per square inch across the tube sheet is one of the unusual conditions to be provided for in a carbon dioxide condenser currently under construction in Kellogg's fabrication shops for a leading chemical processor.

The condenser consists of two shells, 18 inches in diameter, of forged integral channel fixed tube sheet construction. The tubes, 250 per bundle, are of $\frac{3}{4}$-inch admiralty, 20 feet long. The shell cover, channel, and tube sheets are all of steel.

In operation, water will circulate in the tubes at a design pressure of 80 psig. to condense approximately 30,000 lbs. per hour of carbon dioxide under a pressure of 1400 psig.

Just one of scores of exchangers, condensers, coolers, and reboilers that annually come out of its shops, this job illustrates one of an infinite number of extreme conditions Kellogg is experienced and equipped to meet in designing and fabricating process equipment.

For further information, details of methods, etc. contact

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THE
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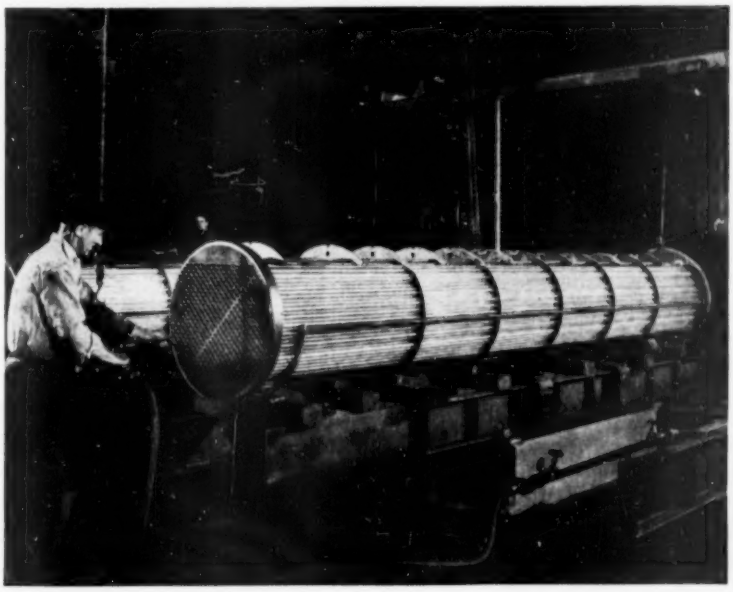

Fourteen Shells for Three Condensers to Have Interchangeable Bundles

Three condensers currently being engineered by Kellogg for a major refiner will represent an optimum in interchangeability of bundles—a feature every refiner wants but one that is often difficult to achieve in a unit without over-engineering it.

The three condenser units, designed to handle C-4 cuts, comprise a total of 14 shells. Following normal design practices, initial Kellogg engineering proposals included three sizes of shells. However, further study by Kellogg engineers proved, in this instance, that it would be most economical in the long run to design the entire group of 14 shells for interchangeable bundles. Both proposals were submitted, the customer agreeing that the interchangeable bundle plan best served their purposes.

Each of the 14 sections are of floating tube sheet construction with 2640 square feet of $\frac{3}{4}$-inch admiralty tubes, naval brass tube sheets, and steel baffles. Inside diameter of each shell is 33 inches. The sections are all designed for 500 degrees F. on the shell side, 300 degrees F. on the tube side, and 300 psig. on one side.

Interchangeable bundles for this many sections will offer several important advantages to the refiner. They will, for example, cut down considerably on refinery maintenance stock, since only one *spare* bundle need be kept in stock to service any one of the 14 sections. Shorter down time for repairs are also expected to result from the fact that the spare bundle can be substituted easily in an emergency without shutting the unit down for lengthy repairs or rebuilding.

. . . An Exact Bevel

One of the two reflux reboiler shells being fabricated in Kellogg's Jersey City shop for a major petroleum refiner. Here a nozzle is being welded to the shell—the final operation that demands the utmost in precision. Holes for these nozzles have been cut with an exact bevel so that a perfect joint results when welding is completed.

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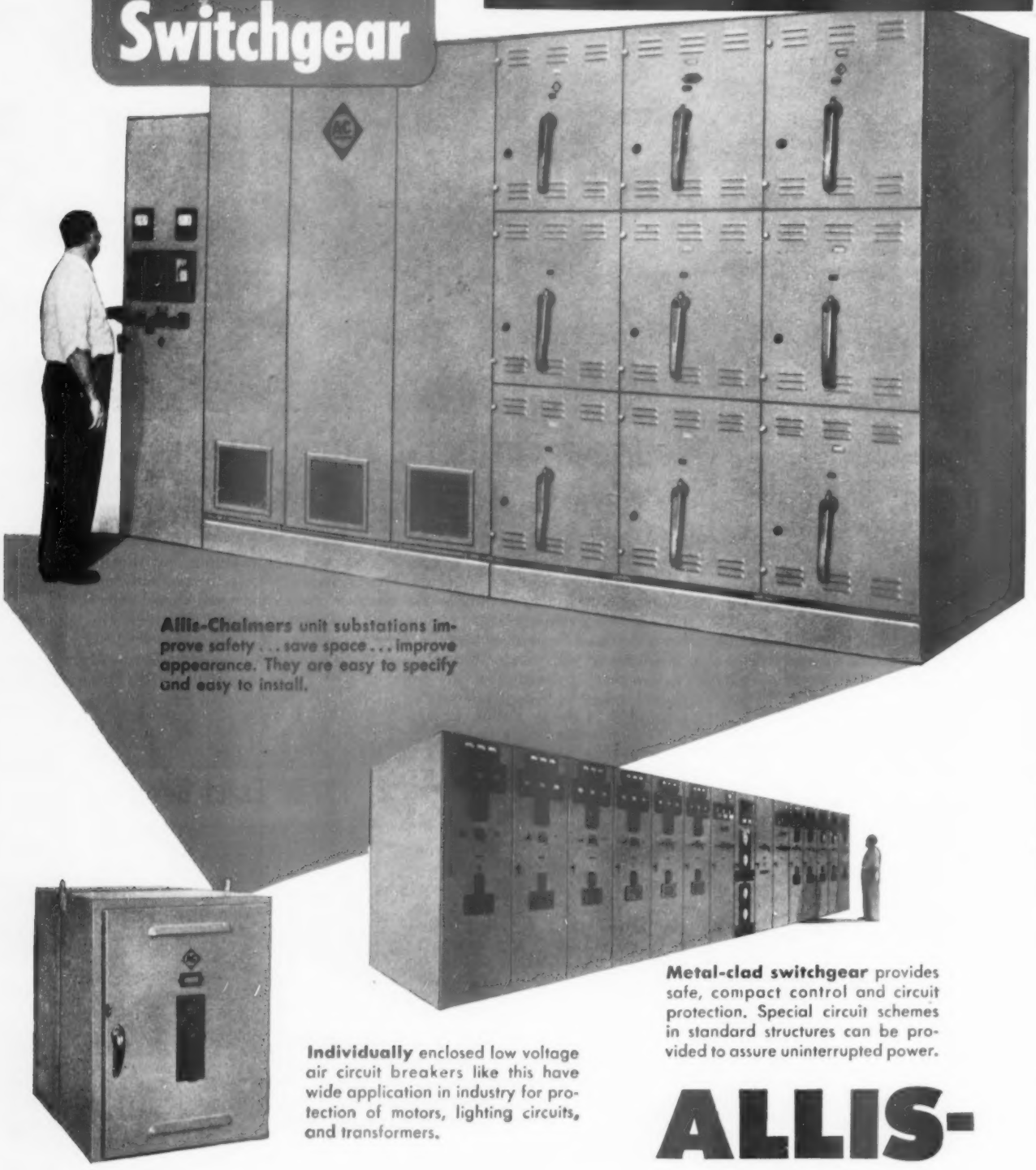
It's Time to

MODERNIZE

ALLIS-CHALMERS
PROGRESS IN
Switchgear



Allis-Chalmers unit substations improve safety . . . save space . . . improve appearance. They are easy to specify and easy to install.

Metal-clad switchgear provides safe, compact control and circuit protection. Special circuit schemes in standard structures can be provided to assure uninterrupted power.

Individually enclosed low voltage air circuit breakers like this have wide application in industry for protection of motors, lighting circuits, and transformers.

ALLIS-

ELECTRICALLY

with Allis-Chalmers Switchgear

when voltage is low

Low voltage at motors is usually caused by overloaded feeders or long runs of low voltage cable. Undervoltage reduces motor torque; increases production time on machine tools; increases time required by heating elements.

when space is limited

Older types of switchgear often use critical production floor space. Replace with compact Allis-Chalmers switchgear. It fits anywhere . . . on the roof . . . on a balcony . . . in the basement . . . or outside near the building.

when cable runs are long

Long low voltage cable runs are wasteful. Savings realized by elimination of long low voltage feeders include cable cost, installation cost and cost of power lost. These savings alone will often justify modern Allis-Chalmers load center unit substations.

when relocation costs are high

Equipment relocation costs are sometimes excessive. Savings in relocation costs due to product changes or production modifications can be made by using Allis-Chalmers switchgear, bus duct and unit substations. Everything is salvageable!

when automation is used

If automation or other continuous processing is used, power interruptions cannot be tolerated. Standard Allis-Chalmers metal-clad switchgear is designed to accommodate special circuit schemes, such as ring bus and transfer bus, to assure uninterrupted flow of power.

when load growth is fast

System capacities now exceed breaker ratings in many plants. Breakers have become obsolete due to increased use of power. These breakers may be inadequate to handle a short circuit, with resulting possible danger to plant personnel and equipment.

Let experienced Allis-Chalmers switchgear engineers help you solve your distribution problems. Call your nearby Allis-Chalmers district office, or write Allis-Chalmers, Milwaukee 1, Wisconsin.

Allis-Chalmers
Milwaukee 1, Wis.

Please send me New Load Center Substation Booklet 11B6285B.

Name

Title

Firm

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City State

A-4247

CHALMERS

they pick it ON PERFORMANCE

Cutler-Hammer

"Oil Country"

Control

Steadily the preference for Cutler-Hammer Oil Well Pumping Control grows. Its performance *proves* it is the genuine Oil Country Control . . . built to oil men's practical specifications not only to start, stop and protect motors and equipment . . . but built to stop the oil country enemies of performance in their tracks.

Aluminum coated cases bounce back the sun's heat. Chimney-draft type ventilation sucks off heat, sucks in cooler air. (You never see a C-H Control cover door propped open to keep it running.) "Out in the open" contacts stay cooler, and, being vertical, shed dust. Ventilator openings are screened, louvred and baffled to keep out dust and dirt and bugs. Neoprene gasketing shields the timer. Excess clock motor torque keeps it ticking along.

Optional 3-coil overload protection ends single phasing; standard 2 coil suffices where single phasing is not a problem.

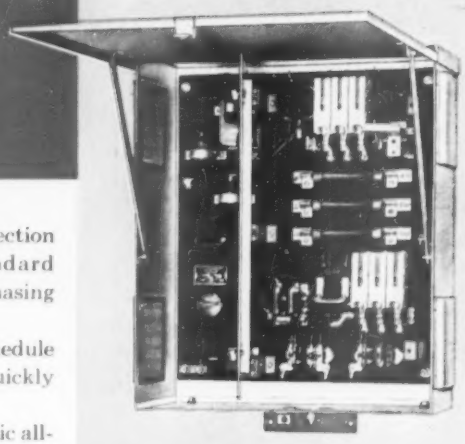
Any type of pumping schedule plus day omission is easily, quickly available.

There's manual or automatic all-at-once or time delay staggered starting available.

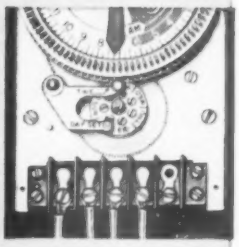
Lightning arrestors protect but don't blow up the works when they pop.

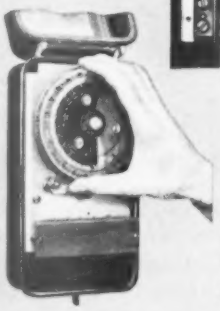
There's every reason in the world for this control's increasing popularity . . . *every reason in the world for you to investigate it too. You'll be glad you did.* CUTLER-HAMMER, Inc., 1453 St. Paul Avenue, Milwaukee 1, Wisconsin. *Associate:* Canadian Cutler-Hammer, Ltd., Toronto, Ontario.

Cutler-Hammer 9589 Oil Well Pumping Controller with 3 coil overload protection and time delay relay.

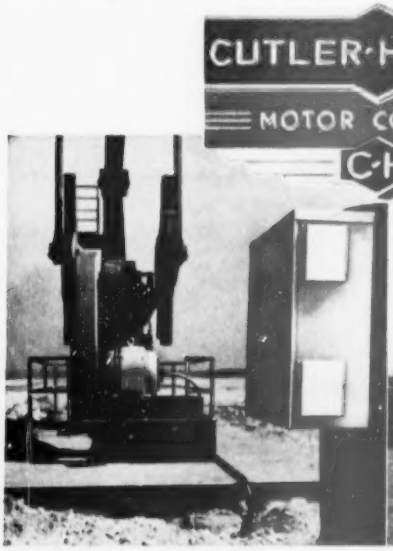


Day-omission feature—for non-operation any selected days of week.





Cutler-Hammer Program Time Switch gives automatically scheduled pumping, set up easily by means of pull tabs—one for each 15-minute interval.



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Carter County, Okla.

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MEMBER AMERICAN PETROLEUM INSTITUTE

When you buy welding elbows . . .

Why take less when you can get more?

. . . (and at the same price)

ADVANTAGES OF MIDWEST "LONG TANGENT" ELBOWS

- They save pipe.
- They often eliminate short nipples and their extra welds.
- They save time and money in lining up and clamping pipe and fitting.
- They make it easier to apply slip-on flanges.
- They remove the circumferential weld from point of maximum stress and can be sleeved.
- THEY COST NO MORE THAN OTHER ELBOWS.

As shown in the illustration above, Midwest "Long Tangent" welding Elbows have straight ends equal to ¼ of the nominal fitting diameter (a 12" elbow has tangents 3" long). For the reasons listed at the left, substantial savings are made on many piping systems by using Midwest "Long Tangent" Elbows. For more information about them, write for Catalog 54.

MIDWEST PIPING COMPANY, INC.

Main Office: 1450 South Second Street, St. Louis 4, Mo.

Plants: St. Louis, Passaic, Los Angeles and Boston

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MIDWEST **WELDING FITTINGS IMPROVE PIPING DESIGN AND REDUCE COSTS**

Two of three Farrel RA-20 vertical right-angle units installed in the Continental Oil Company's refinery at Billings, Montana. These units are designed to transmit 250 HP from steam turbines at 4000 RPM to deep-well water pumps at 1746 RPM.

Farrel® vertical drives give you protection against down time

Farrel type RA vertical drives are used extensively for transmitting power and either increasing or reducing speed from internal combustion engines or high-speed turbines to vertical pumps.

These drives feature a hollow vertical shaft which permits easy adjustment of the pump shaft without disturbing the gears or bearings.

To insure continuous, trouble-free service, without the maintenance-demanding infirmities caused by wear, Farrel engineers have designed in special protection at five vital points.

Write for further details.

FB-901

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ANSONIA, CONN.

Plants: Ansonia and Derby, Conn., Buffalo, N. Y.
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OIL FIELD REPRESENTATIVES
Hercules-Lupfer Engine Sales Co., 124 N. Boston St., Tulsa 1, Okla.
V. W. Osborne, 860-A M & M Building, Houston 2, Texas

AT 5 VITAL POINTS

1 **HOUSING**—The housing is a rigid, compact design, made of close-grained cast iron. All joints are finish-machined and are oil-tight and dust-proof.

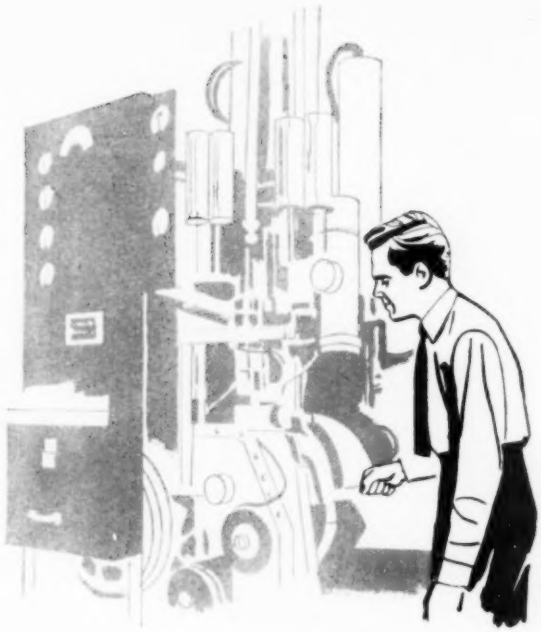
2 **GEARS**—Power transmission is accomplished through one pair of spiral bevel gears with curved teeth, of forged steel, precision generated, hardened and lapped. The method of mounting assures maintenance of original precise alignment.

3 **SHAFTS**—For further protection of correct alignment, shafts are of forged steel, oversized to guard against deflection, and mounted in two widely spaced bearings.

4 **BEARINGS**—All bearings are antifriction type, factored for long life. Thrust bearings are selected and housing is designed to take heavy thrust load.

5 **LUBRICATION**—A self-priming, positive pump in the base of the unit feeds the correct amount of oil to gears and bearings.

Farrel-Birmingham®



If you'd like to

add 3 OCTANE NUMBERS try...

AEROCAT®

MS SYNTHETIC CRACKING CATALYST

Recently 42 cat crackers reported to Cyanamid the results of their cracking operations: Units on natural catalyst were getting an average of 90.5 octane (research clear). Those on AEROCAT were getting an average of 93.1 octane (research clear).

Which indicates again that where high octane is the order, AEROCAT is the answer.

This alone, of course, does not account for the fact that *among all cat crackers now using synthetic, 8 out of 10 use* AEROCAT. They use AEROCAT because:

1 AEROCAT is the surest, most economical means not only to high octane but also to

- high throughput
- low CO_2/CO ratio in flue gas
- high isobutane yield
- excellent heat, steam and sulfur stability

2 AEROCAT is a product of American Cyanamid Company – which has the research facilities, the technical service staff, and the experience required to develop solutions to individual application problems.

3 Cyanamid can be relied upon as a source of supply.

How about your own cracking operations? Are you getting 93 octane . . . plus the many other AEROCAT advantages? If not, write or call Cyanamid's Technical Service representative.

AMERICAN Cyanamid COMPANY

REFINERY CHEMICALS DEPARTMENT

30 Rockefeller Plaza, New York 20, N.Y.

In Canada: North American Cyanamid Limited, Toronto and Montreal

TAKES THE BLOW OFF...
CUSHIONS SHOCK

PENFLEX TUBING

ABSORBS THERMAL EXPANSION... PREVENTS BLOW-OUT

WHEN SAFETY VALVES pop in this large industrial plant, a terrific surge of 900°F. steam blasts through the blow-off pipes under as much as 850 psi pressure. Ordinary pipe would blow apart. But Penflex Flexible Metallic Tubing has enough "give" to take the shock. Six lengths of 8" Penflex interlocked tubing cushion the sudden impact . . . take up any pipe movement due to extreme temperature and pressure changes.

The Penflex Engineer can help you solve your tough tubing problems. A complete line of Penflex Flexible Metallic Tubing, Hose, and Couplings is at your disposal—4-wall interlocked and seamless welded corrugated tubing and metallic hose from 1/8" to 24" I.D. . . . automatic barrel fillers, pneumatic rivet passers, and fittings. Write for the new illustrated data book, "Flexineering."

Pennsylvania Flexible Metallic Tubing Company, Inc.
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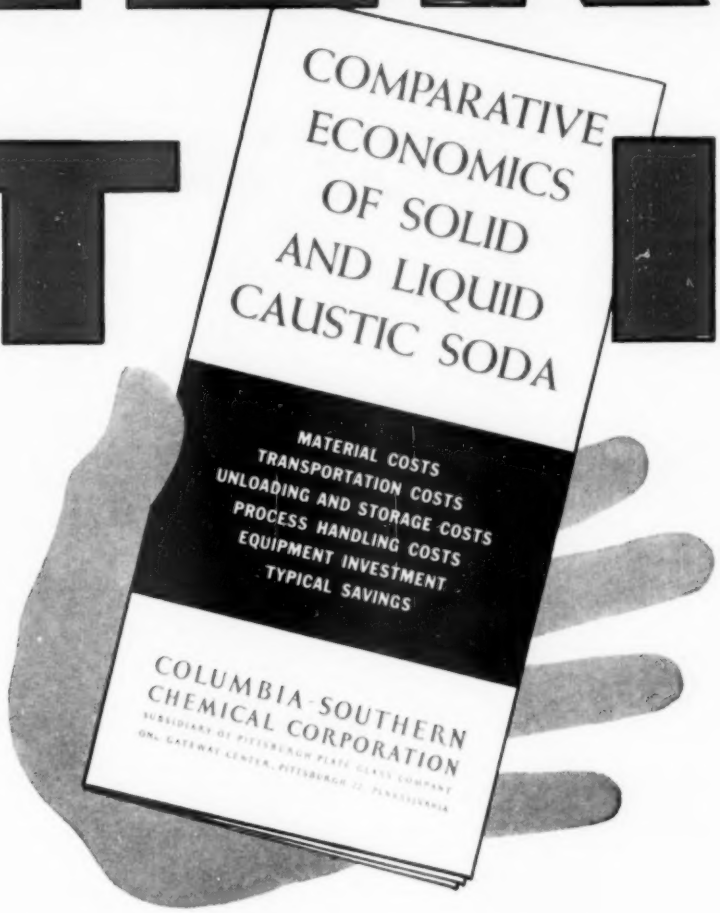
Offices: Boston • New York • Chicago • Houston • Cleveland • Los Angeles

PENFLEX

HEART OF INDUSTRY'S LIFE LINES

HERE IT IS



YOUR PROFITABLE GUIDE AND IDEA BOOKLET ON CAUSTIC SODA

The first time ever published, this handy, easy-to-read reference booklet packs a lot of facts in a few orderly pages.

Answers the questions: "What form of Caustic Soda should I buy?" "How do I figure costs?" "How much will I save?" "What equipment will I need?" "What about transportation and unloading?"

GET YOUR FREE COPY NOW!

If your work involves the use of caustic soda, you will find this booklet very helpful. Write today on company stationery for Comparative Economics Booklet, Columbia-Southern Chemical Corporation, One Gateway Center, Pittsburgh 22, Pennsylvania.

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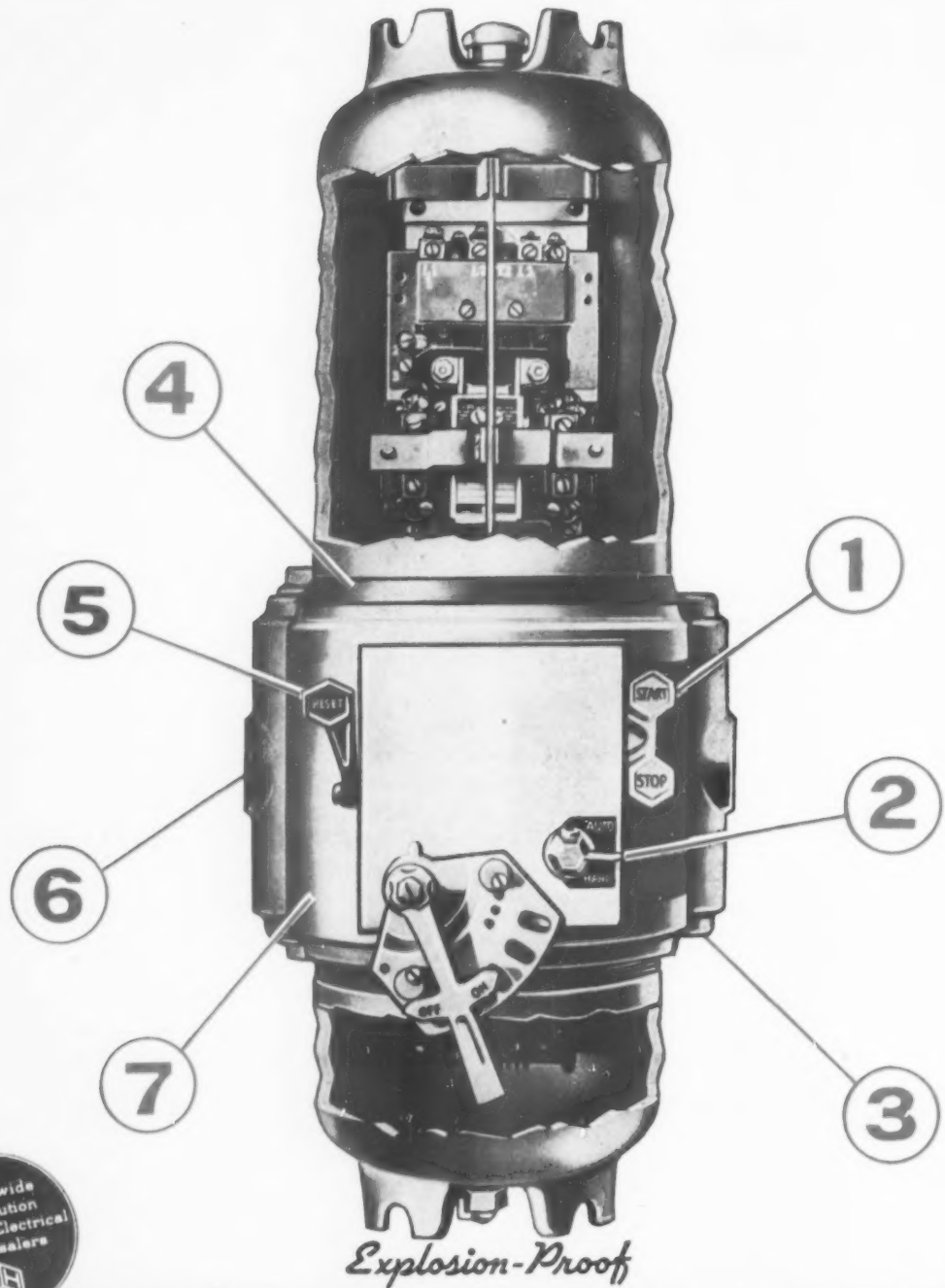
7 important NEW features

... to the many basic advantages of



Explosion-Proof

A Nationwide Distribution Through Electrical Wholesalers

CONDULETS • TRAFFIC SIGNALS •

have been added
CROUSE-HINDS Type EPC
motor starter and circuit breaker CONDULET *

You get all of them on the Model M52

Model M52 EPC is the most flexible explosion-proof line starter and circuit breaker enclosure ever produced. The addition of 7 new features to the proven basic advantages of the EPC construction assures the greatest ease of installation and maintenance.

The exclusive basic advantages of the EPC Condulet have made it the world's leading enclosure for housing motor starters, circuit breakers and combinations for use in hazardous locations.

The basic advantages are:

EASY INSTALLATION . . . The use of a strong light-weight aluminum alloy and the unique three-section design makes it practical for an electrician and his helper to install the largest housing without the use of costly lifting equipment. The internal devices can be easily removed for pulling in the wires.

THREADED JOINT CONSTRUCTION . . . All joints are threaded. All operating shafts and bushings are thread-in-thread construction. This insures maximum safety, easy inspection and maintenance, and maximum corrosion protection.

FLEXIBILITY . . . A large number of different enclosures can be assembled from the wide variety of sizes of bodies and covers. They are not only used for circuit breakers and starters but have proven adaptable for many other types of electrical equipment. The body has numerous conduit hubs for flexibility of installation.

COST AND TIME SAVINGS . . . The outstanding advantages of the unique EPC Condulet over conventional explosion-proof enclosures all add up to lower installed cost and lower maintenance cost.

All of these advantages have been available for years.

Now Crouse-Hinds offers you 7 new improvements to underline the basic advantages of type EPC Condulets and to save you more dollars and more man-hours than ever before.

1. **Built-in Push button stations** available on line starters and combinations of line starters with circuit breakers — START — STOP, FOR — REV — STOP and HIGH — LOW — STOP stations for regular, reversing, or two-speed starters.
2. **Built-in selector switch** is available on line starters and combinations of line starters with circuit breakers. Normally supplied marked HAND — OFF — AUTO or JOG — RUN — OFF, three-position style. Two-position selector switch or combinations of selector switch with START — STOP station can be supplied.
3. **Back conduit entrance** can be supplied by drilling and tapping the boss in the center of the back . . . in addition to the four regular top and bottom hubs.
4. **Protective Neoprene gasket** is available for the upper cover joint. Where EPC Condulets are exposed to unusually severe weather or corrosive conditions, this gasket provides additional protection.
5. **A new RESET lever with threaded shaft,** rotating within a threaded bushing, provides easier and more positive operation of the reset mechanism.
6. **Horizontal through-feed conduit entrances** are provided by drilling and tapping bosses on the sides of the Condulet body.
7. **Greater ease in wiring** is provided by increased height in the center body section and by universal use of open framework mountings for circuit breakers and starters in the new model M52 EPC Condulets.

Model M52
Type EPC Explosion-Proof
Condulet in 7, 9, and 11-inch
body sizes

Send for YOUR copy of Bulletin 2634 →

*CONDULET is a coined word registered in the U. S. Patent Office. It designates a product made only by the Crouse-Hinds Company.

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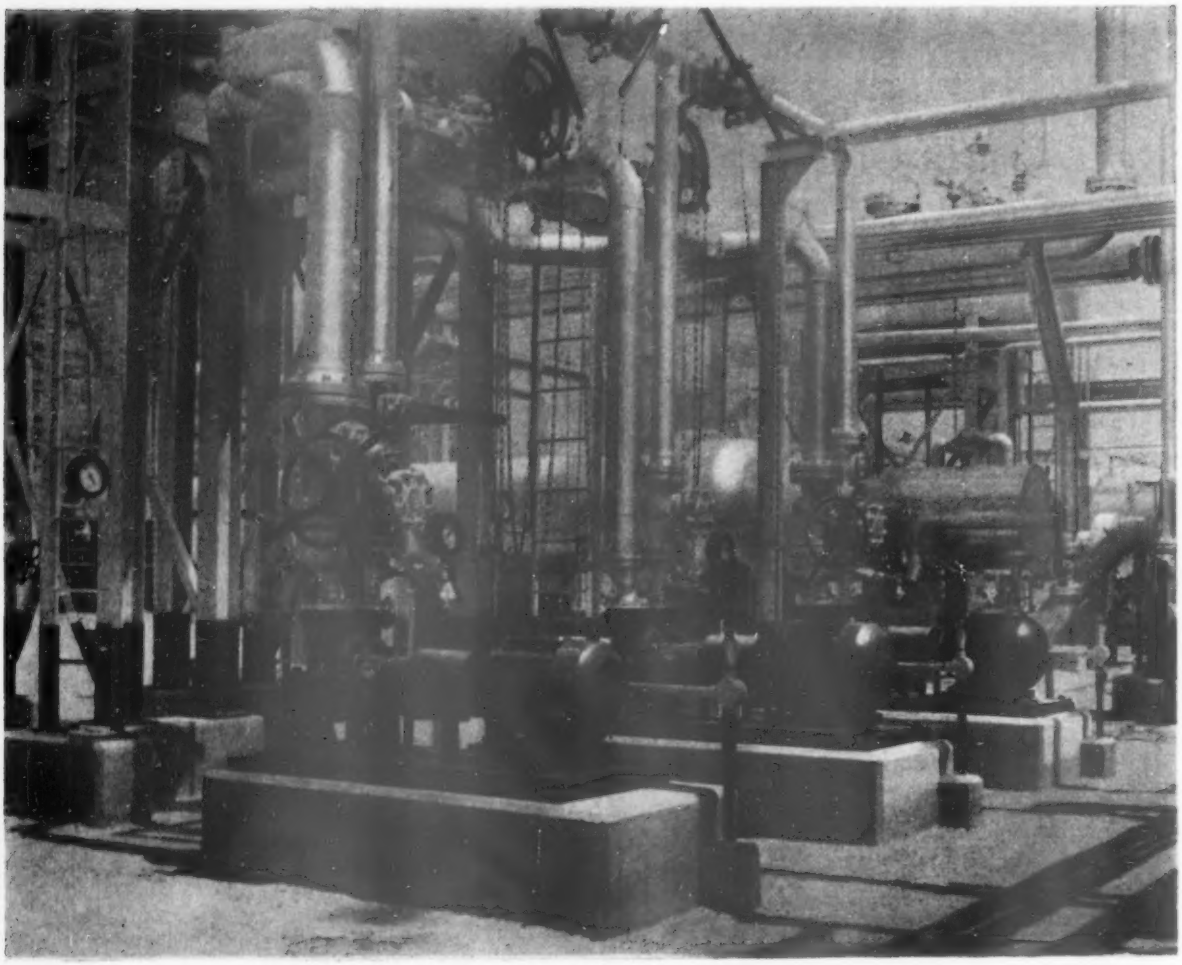
AIRPORT LIGHTING • FLOODLIGHTS

at 3-BAR GAS INJECTION & GASOLINE PLANT



Ingersoll-Rand SFLA Pumps meet a wide range of processing requirements at this Andrews, Texas plant operated by Stanolind Oil and Gas Company. The three 1½" SFLA units shown above are on debutanizer and depropanizer reflux service, handling 128 gpm of 90°, .55 sp. gr. reflux at 52 psig suction and 102 psig discharge. Other similar I-R pumps at this plant are used for still reflux, scrubber condensate and caustic mix services. The totally enclosed design of the rugged SFLA line, with integral mechanical shaft seal, assures maximum safety and dependability in refinery and process services.

Ingersoll-Rand, Cameron Pump Division, 11 Broadway, New York.

981-10

SAFER...STRONGER...WORKS FOR YOU LONGER!

Complete Factory Coupling, Resetting and Salvage Service

Your worn or damaged Hewitt-Robins Cable-Reinforced Rotary Hose can now be repaired and reset with new couplings at our factory repair facilities in Houston, Texas. We'll rebuild lengths of 30 feet or longer as rotary hose, and reset them with new, exclusive in-line Stratolire Couplings . . . or repair and recouple lengths of less than 30 feet to provide one or more lengths of Rotary Flexible Hose.

You'll be way ahead in rotary hose value when you buy Hewitt-Robins Cable-Reinforced Rotary Drilling Hose. First of all, it's the safer, stronger, longer-performing rotary hose with exclusive Stratoline Coupling. And *now* it can give you thousands more feet of extra drilling service . . . save you time and money . . . thanks to our new factory repair and salvage facilities in Houston, the need to scrap worn or damaged Hewitt-Robins Cable-Reinforced Rotary Hose has been eliminated.

ENGINEERING DATA

CONSTRUCTION: Two high-tensile airplane cable wires spiraled on, in opposite directions, to equalize tension and control elongation. Third cable applied to eliminate dancing and shimmying . . . Has strength to match highest operating pressures—flexibility to drape smoothly on any type of rig.

TUBE: Neoprene-base synthetic compound meets all current operating requirements, including high mud temperatures, oil-based mud and oil emulsions.

COVER: Neoprene-base synthetic compound—resists oil, sun-checking, strain crack, cutting abrasion, weather and temperature extremes. Black with longitudinal yellow stripe to ease alignment.

SAFETY EYE: Permanently fused to hose body 29" from threaded end of coupling at each end of hose for attaching safety chain to derrick and swivel—eliminates need for external clamps.

The new Hewitt-Robins Cable-Reinforced Rotary Drilling Hose is now available at these Oil Field Supply Outlets:

THE BETHLEHEM SUPPLY COMPANY OF CALIFORNIA

MID-CONTINENT SUPPLY COMPANY

NORVELL-WILDER SUPPLY COMPANY

STANDARD SUPPLY & HARDWARE COMPANY

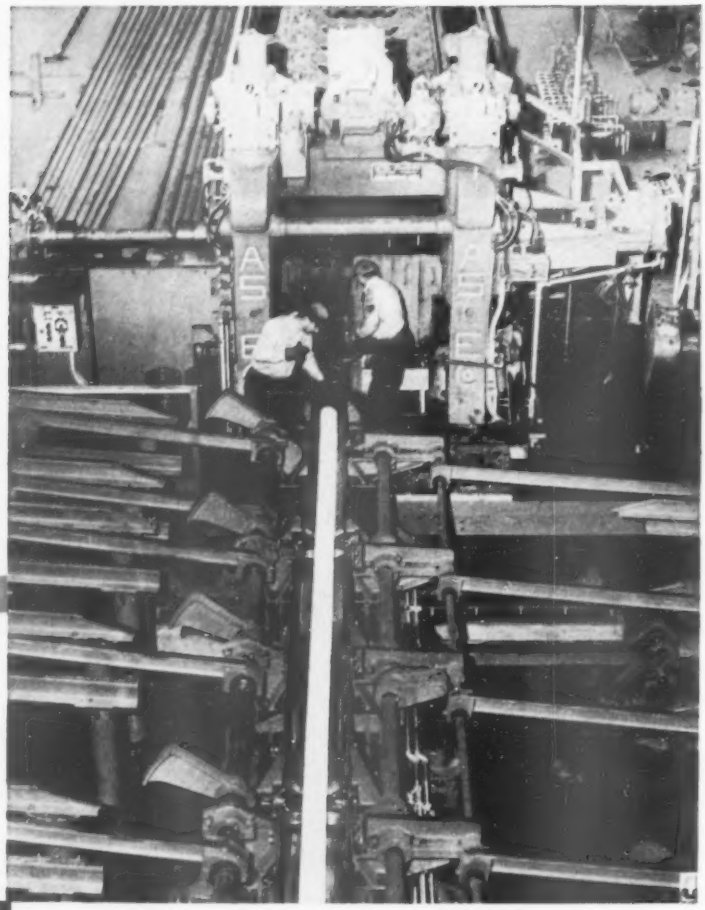
HEWITT HR ROBINS

Executive Offices, Stamford, Connecticut

DOMESTIC DIVISIONS: Hewitt Rubber • Robins Conveyors • Robins Engineers • Restfoam

FOREIGN SUBSIDIARIES: Hewitt-Robins (Canada) Ltd. Montreal • Hewitt-Robins Internationale, Paris, France • Robins Conveyors (S. A.) Ltd., Johannesburg • **EXPORT DEPARTMENT:** New York City.

"rolling along"



AT THE CF&I SEAMLESS TUBE MILL

In efficiency and high output, this plug rolling mill is typical of the modern equipment used throughout every stage of production at the new C F & I Seamless Tube Mill in Pueblo, Colorado.

Here, rough tubes from the piercing mill are lengthened as their walls and diameters are reduced to the wall thickness required.

To the oil and gas industries of the West and Southwest, these up-to-the-minute facilities of the modern C F & I Seamless Tube Mill are definite assurance of better service . . . bringing them convenient and dependable supplies of seamless tubing and casing of the highest quality.

C F & I Seamless Oil Country Tubing and Casing meet API STD 5A specification and are available in sizes from 2⅜" O.D. through 9⅝" O.D.

CF&I TUBULAR PRODUCTS

THE COLORADO FUEL AND IRON CORPORATION

DENVER, COLORADO

CF&I

2217

CHEMICAL PROCESS NEWS

PUBLISHED BY CHEMICAL PROCESS DIVISION, THE M. W. KELLOGG COMPANY — MAR. 1954

NOTES ON PHTHALIC ANHYDRIDE

Of interest to chemical processors in general, and particularly in the United States where the irregularity of supply of naphthalene has hampered the production of phthalic anhydride, is the development of a new feed-preparation step in Kellogg's laboratories which permits the use of low-grade, sulfur-containing naphthalene in the Fluid phthalic anhydride process.

* * *

This step in effect increases the supply of feed available for the Fluid process with its recognized advantages over conventional methods: higher yields . . . lower initial cost . . . easier handling of catalyst . . . longer catalyst life . . . increased safety through better control of heat.

* * *

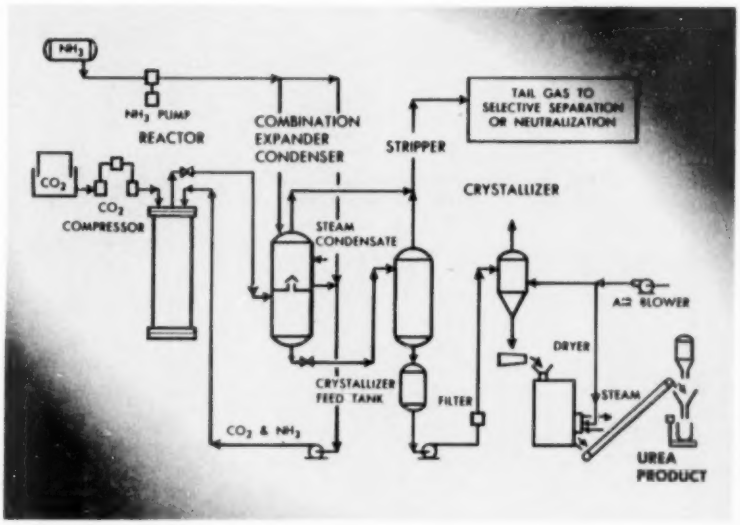
Meanwhile several design improvements are incorporated in new Fluid phthalic plants designed and now being erected by Kellogg. When these units are completed they will produce about 50 million pounds of phthalic annually.

* * *

While the basic chemistry involved in the oxidation of naphthalene in the presence of a catalyst is well known to chemical manufacturers, new developments in the process for this chemical have not been extensively publicized.

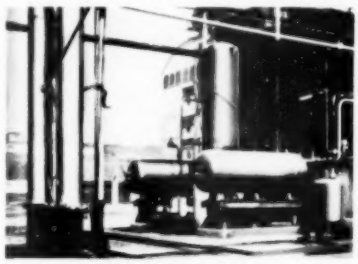
* * *

One of these is an improved condensing system which may be included under certain circumstances. This not only reduces capital investment but also improves actual operating conditions. It precludes, for example, the need for operators to come in direct contact with the phthalic or its fumes.



Montecatini Process Produces Higher Quality Urea at Lower Investment

The new low-cost method of producing synthetic urea of exceptional purity developed by Montecatini—well-known Italian firm—



Ammonia weigh tanks

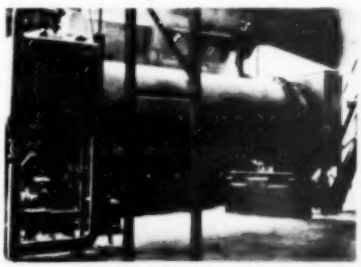
is shown in the flowsheet above, while accompanying photos show some of the actual equipment. Kellogg is the exclusive licensor of the process, a method which reflects more than 30 years of experience in nitrogen chemistry.

One of the most important features of the Montecatini process is virtual elimination of corrosion problems generally associated with urea synthesis. This is accomplished not only through careful selection of materials but also through maintaining a high concentration of ammonia which tends to curb corrosion. Furthermore, relatively mild conditions are employed in the reaction zone in comparison with other urea processes, thus further limiting corrosion.

As a result of these factors, considerable costly alloy equipment is eliminated from many parts of the plant and maintenance expense is held at a minimum.

In addition to these factors affecting the costs of plant and operation it is also of interest that the process produces resin-grade urea without the additional expense of special purification steps. An aqueous solution of 5% urea from a Montecatini plant is clear and colorless, a difficult specification to meet and one which is particularly important for plastics manufacture. A low biuret content of less than 0.01 wt.% is also obtained.

From the standpoint of using the urea as a feed supplement, it is also of importance that no lead-lined equipment is employed in the process, eliminating the possibility of lead toxicity.



Rotary dryers

(SEE REVERSE SIDE)

CONTINUED FROM PRECEDING PAGE

Unique Ammonia Plant Completed On West Coast

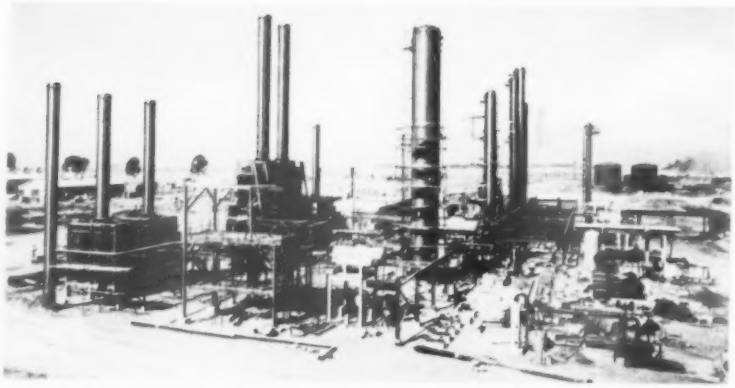
A unique anhydrous ammonia plant, employing a special high-pressure gas reforming step, is now on stream on the West Coast. It will produce well over 300,000 pounds of product daily from a natural gas feed stock.

The unusual reforming step is the result of studies conducted in a Kellogg semi-commercial plant which showed that important economic savings could be made in the process. All that was required was to take full advantage of the relatively high pressure at which natural gas is available.

Based on this research, Kellogg engineered the reforming sections of this new plant to conserve the potential energy of the natural gas feed. This contrasts with usual practices that produce low-pressure synthesis gas. Although the synthesis gas must be still further compressed before it is charged to the ammonia converters the new high-pressure reformer conserves about 25 to 35% in compressor horsepower.

The section operates at about 100 psi and the over-all effect of the new design is economy in operation without loss of reaction efficiency. Further information on the Kellogg ammonia process is contained in a new booklet which is available on request from Kellogg's Chemical Process Division.

Work Progresses on Sasol Plant



Shown here are two major sections of the multi-million-dollar synthesis project now under construction by Kellogg in South Africa. While the primary purpose of the plant is to synthesize gasoline and other oil products from coal, it will also produce large volumes of valuable chemicals which will be purified in Kellogg-designed equipment. (Photo above shows fractionation equipment for both oil products and chemicals.)

Shown in its early construction stages (below) is the most important unit in the process sequence. This is the Kellogg Synthol unit which will catalytically convert synthesis gas to liquid hydrocarbon and chemical products.

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A new booklet on the production of ethylene from a variety of feed stocks has just been issued by Kellogg. It provides data on the use of Kellogg's unique steam pyrolysis process in cracking reduced crude, gas oil, naphtha, propane and ethane. For a copy write THE CHEMICAL PROCESS DIVISION, the M. W. Kellogg Company, 225 Broadway, New York City 7.

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For further information, technical data, etc., relating to chemical or petrochemical processing, write

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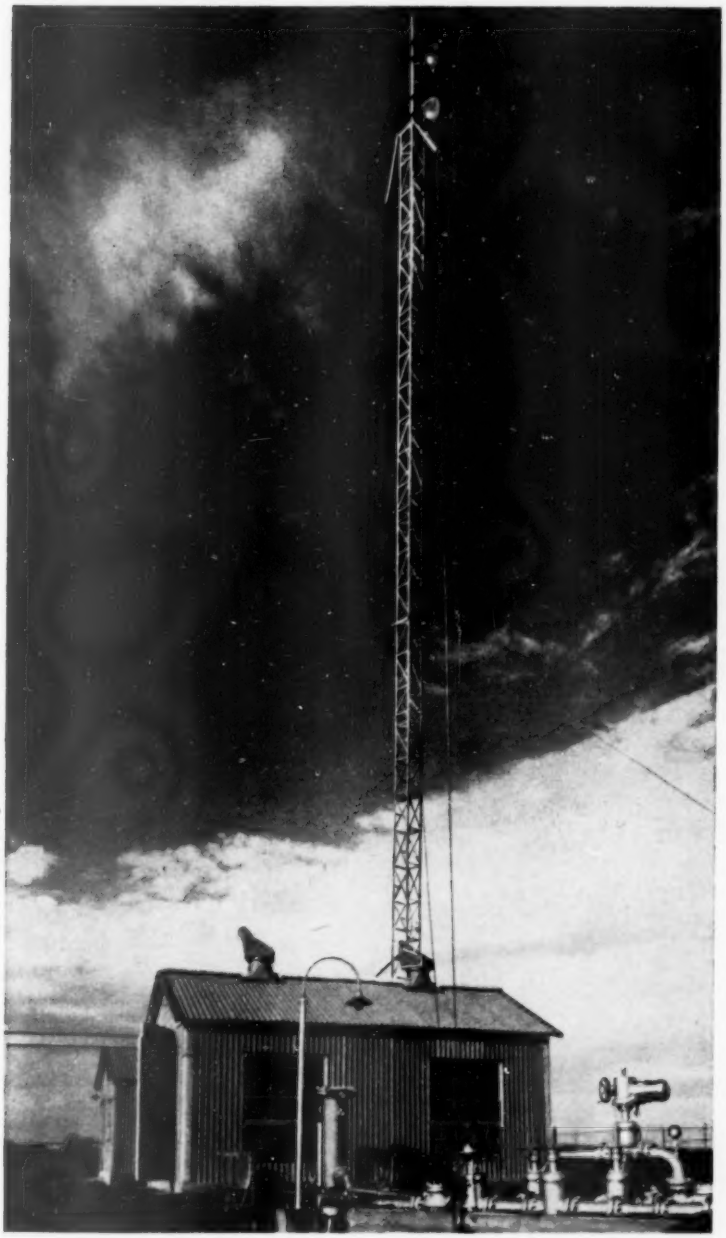

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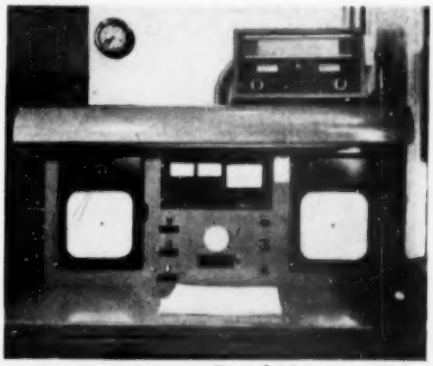

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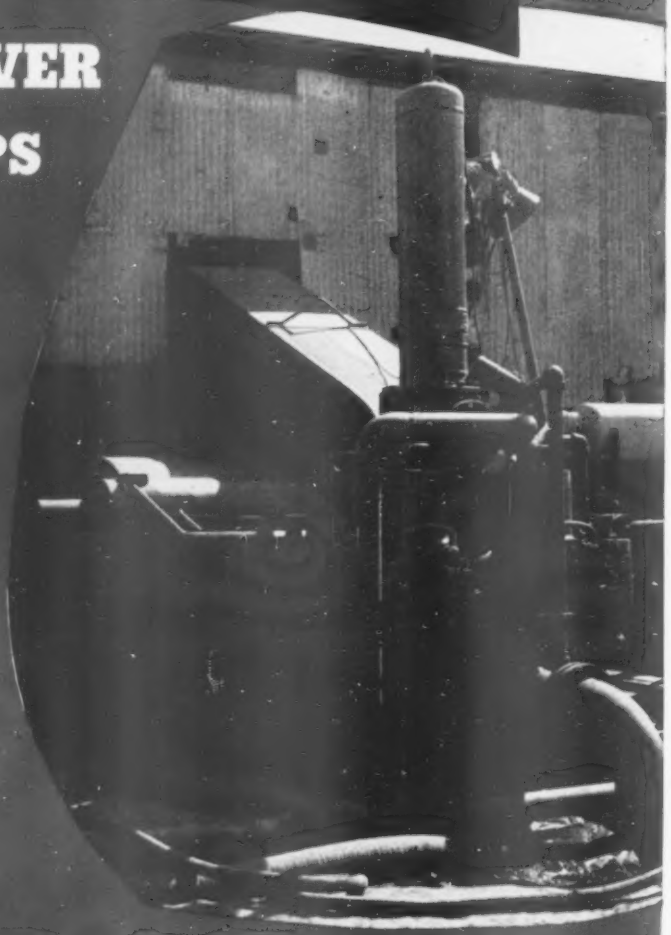

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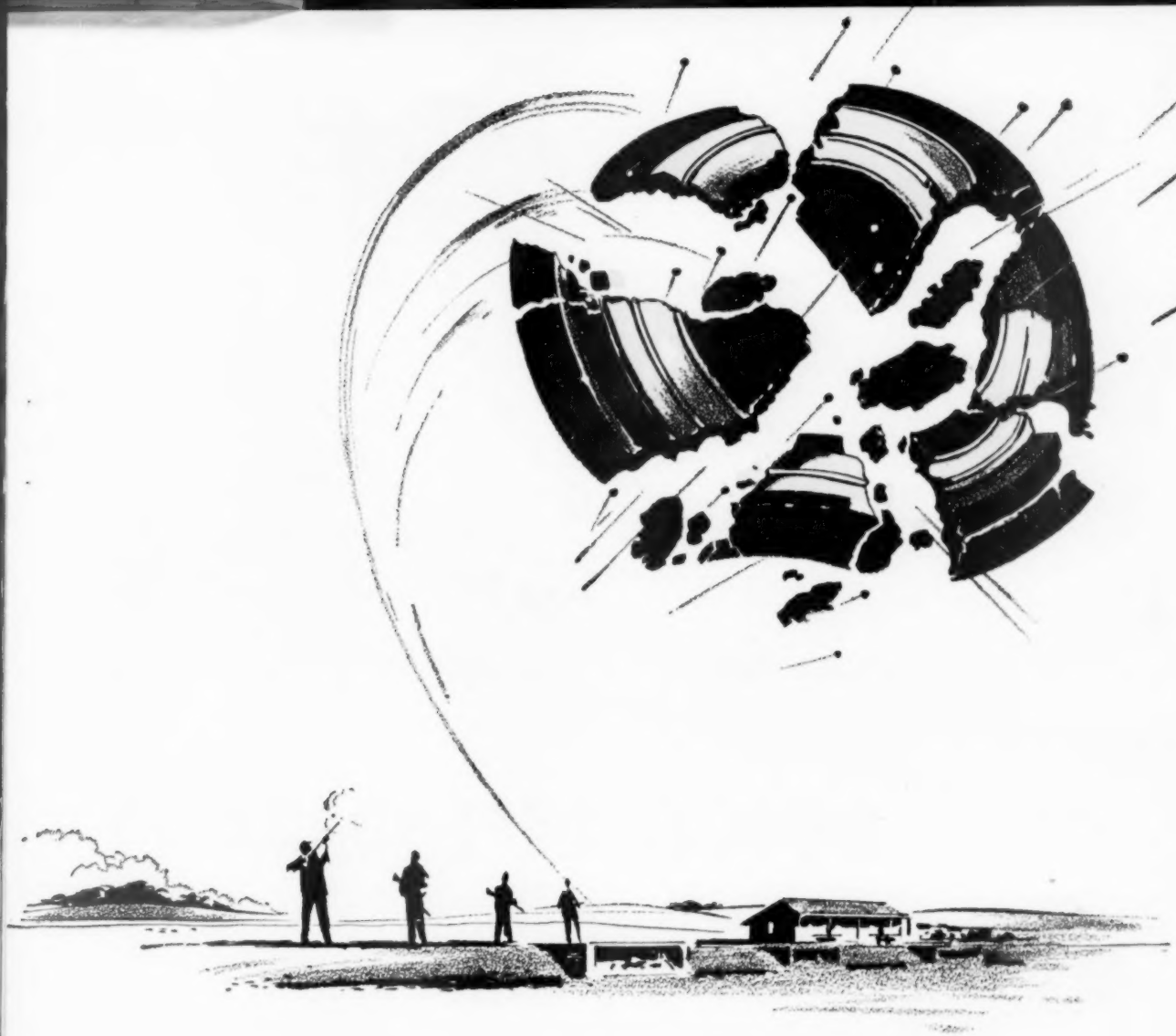

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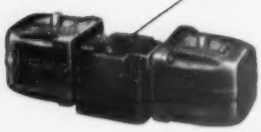

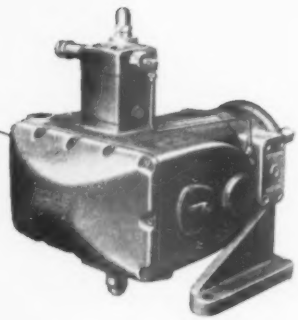

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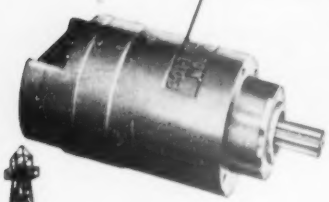

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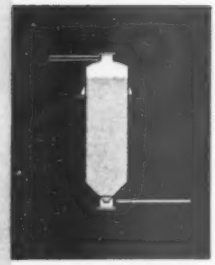

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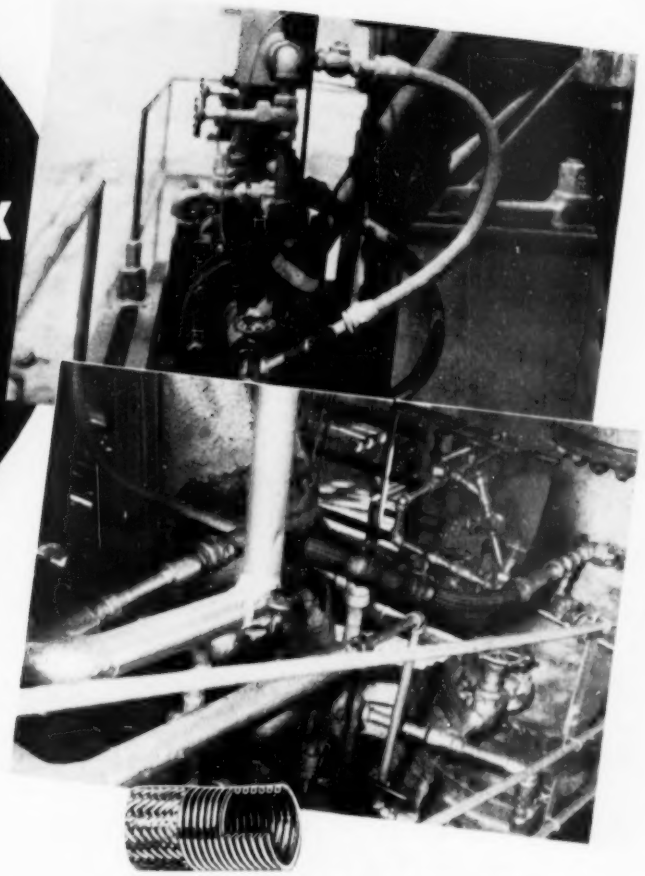

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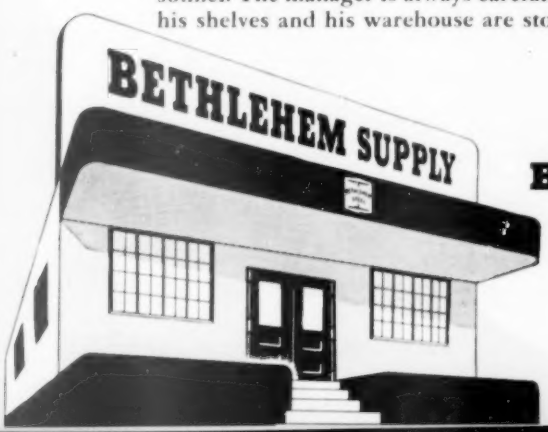

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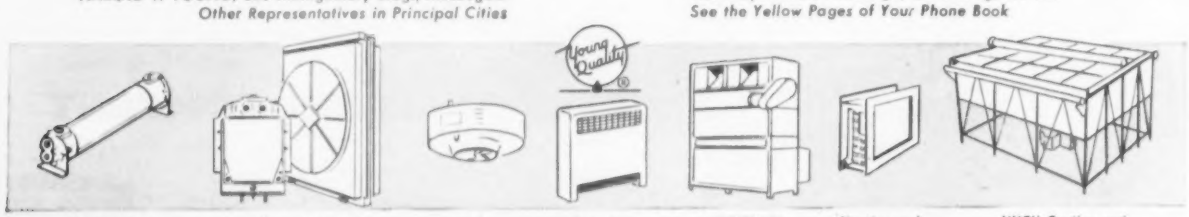

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Bolted Bonnet

Outside Screw and Yoke

Sizes: 1 4" through 1"

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4. **Stainless steel swing bolts and nuts.**
5. **Highly accurate guiding to prevent wedge dragging on seating surfaces and consequent leakage.**
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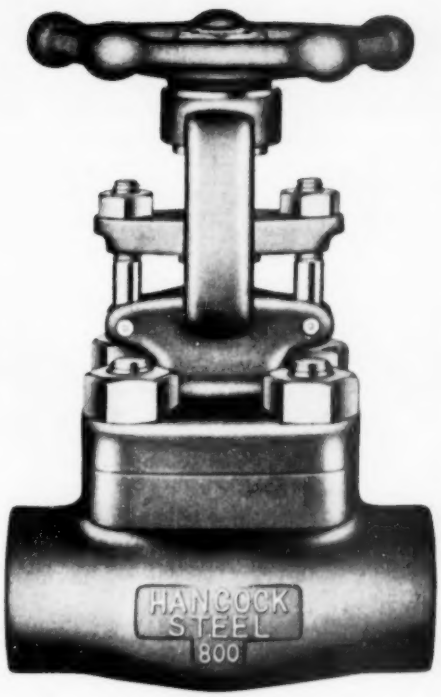

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Screwed and Socket Weld Ends: For all pressures up to 800 psi at 775°F. — O.W.G. 2000 psi, 100°F.

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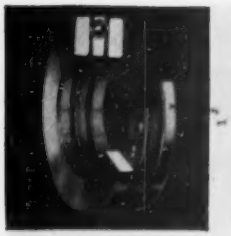

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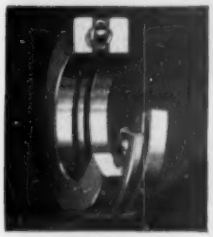

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R SERIES • Ball thrust retainer. One piece, pressed steel, channel type cage . . . 79 inch sizes 0.266" to 4.232" I.D.

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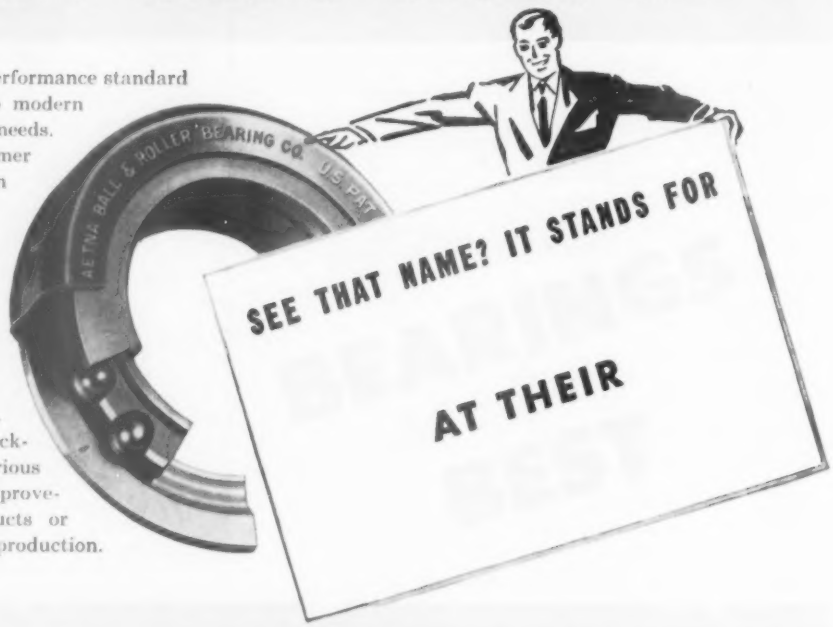

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Write **for latest catalog. Contains specifications on Aetna's complete line—vital technical reference data on bearing selection, load capacities, lubrication, care and maintenance.**

Thermoid Powerflex . . . Recognized Standard of Rotary Hose Quality

Here's Rotary Hose that's unrivalled for strength and flexibility. Thermoid Powerflex combines oil-and-abrasion-resistant synthetic tube with impregnated multi-ply woven fabric and high tensile steel cable reinforcement. Its tough, extra-heavy cover resists weather and abrasion.

Patented full-flow couplings, securely anchored to each individual cable, are guaranteed leak-proof—positively cannot blow off. Powerflex is available in all standard sizes and lengths. It is pre-tested to 5,000 psi . . . exceeds all API requirements.

Get premium quality at regular price. Specify Thermoid Powerflex Rotary Hose—the most widely imitated Rotary Hose in the oil fields!

Mid-continent Office and Warehouse, Houston, Texas
California Office and Warehouse, Los Angeles, California

Powerflex Rotary Hose • Trioflex Slim-Hole Rotary Hose • Mud-Flo Slush Pump Hose • Flexible Discharge Units • F.H.P. and Multiple V-Belts • Oil Country Flat Belting

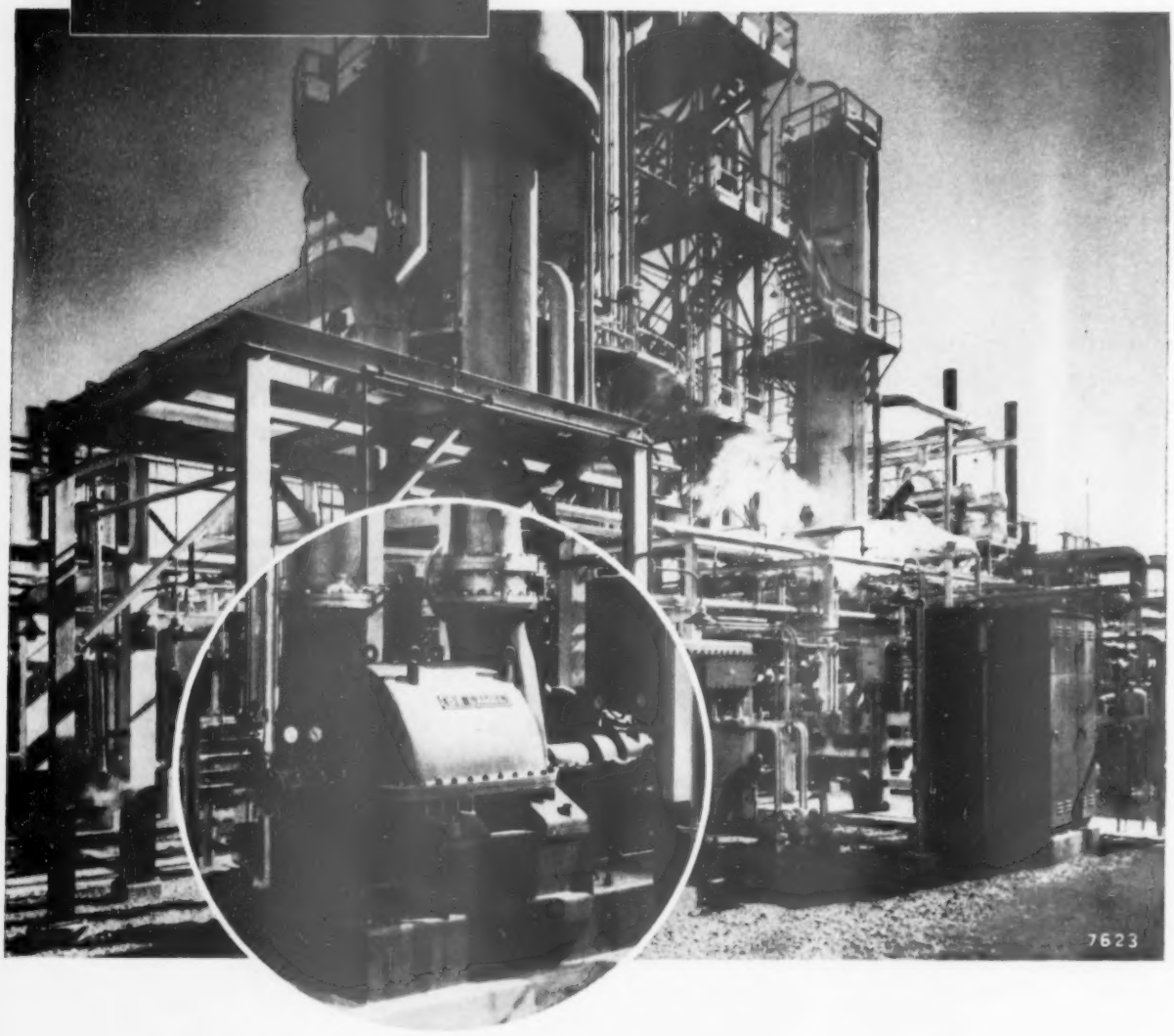
Thermoid

Wire Line Turn Backs • No-Wip Line Savers • Stuffing Box Rings • All Types of Hose • Molded Specialties • Brake Blocks

Thermoid Company • Offices & Factories: Trenton, N. J., Nephi, Utah

DE LAVAL CENTRIFUGAL BLOWER

delivers 17,400 cfm for Elreco's new cat



This De Laval Centrifugal Blower, on stream at the El Dorado Refining Company's new cat cracker at El Dorado, Kansas, supplies 17,400 cubic feet of air per minute for regeneration of the spent catalyst.

This plant, built in record time of ten months by The Refinery Engineering Company, is designed for a charge capacity of 4,300 barrels per day at 75% conversion.

Elreco is another of many refineries which have chosen De Laval for dependable blower performance under heavy-duty, continuous operation. Rugged castings, husky, perfectly balanced rotor and externally mounted, cylindrically seated bearings are design features that reduce maintenance and insure long service. Send for Bulletin 0500 containing complete data.

DE LAVAL *Centrifugal Blowers*

DE LAVAL STEAM TURBINE COMPANY

810 Nottingham Way, Trenton 2, New Jersey

DL-207

Completing Our

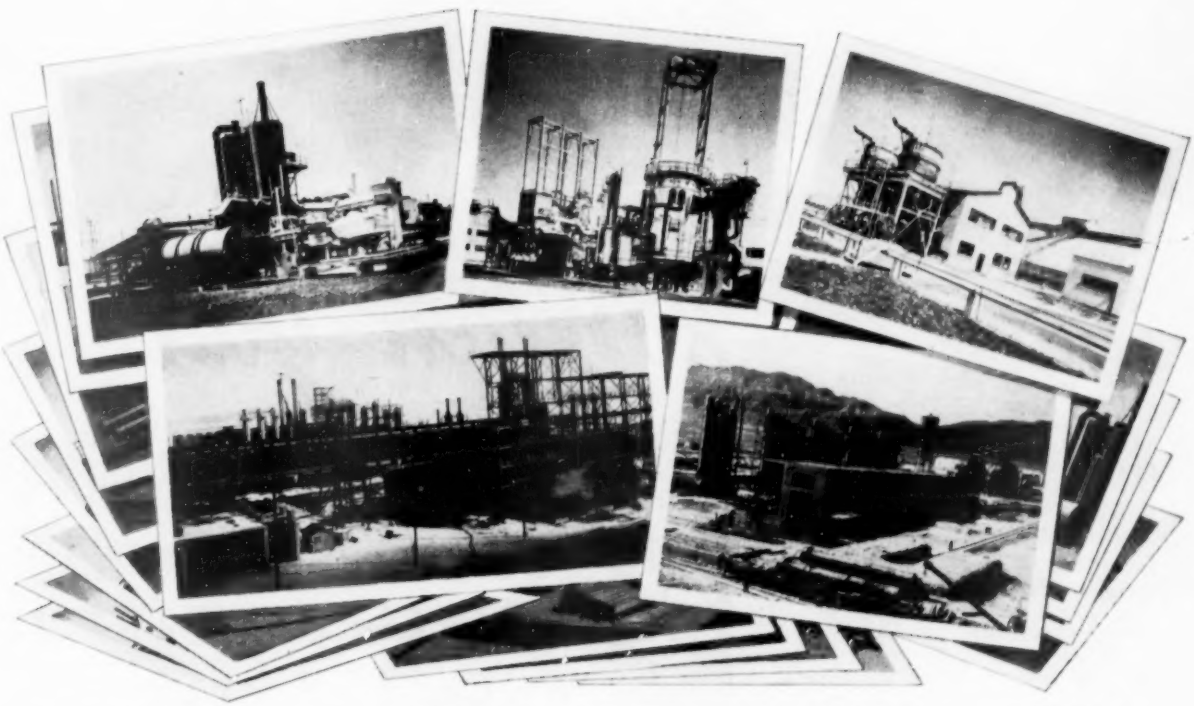
40th

Year of Service to the Chemical Industry

Generally, there's not much point in telling people how long you've been in business. But it so happens that the 40 years of Chemico's existence also marks the period of greatest growth of this country's huge chemical industry. Chemico is proud of its part in the development of this industry . . . a development that required more than a little pioneering courage.

They say that "Life begins at 40" because that age combines seasoned judgment with youthful vigor. At this 40th Anniversary Chemico certainly offers experience, initiative and the assurance that you can, as always, depend upon the promise in our slogan:

"Chemico plants are profitable investments"



CHEMICAL CONSTRUCTION CORPORATION

A UNIT OF AMERICAN CYANAMID COMPANY

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CABLES: CHEMICONST, NEW YORK

TECHNICAL REPRESENTATIVES: CYANAMID PRODUCTS LTD., LONDON • CHEMICAL CONSTRUCTION (INTER-AMERICAN) LTD., TORONTO • SOUTH AFRICAN CYANAMID (PTY) LTD., JOHANNESBURG

CHEMICO CHEMICAL CONSTRUCTION CORP

CC-840

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upon whom you may DEPEND...

...When You

"Buy From Bovaird"

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PETROLEUM EQUIPMENT SUPPLIERS ASSOCIATION
PARTNERS IN PETROLEUM PROGRESS

YOU GET WHAT YOU WANT
WHERE YOU WANT IT
WHEN YOU NEED IT...

THE Bovaird SUPPLY COMPANY

GENERAL OFFICES
TULSA, OKLAHOMA

83 YEARS OF PROGRESS WITH THE OIL INDUSTRY

Hardfacing

Check the **COMPLETE VICTOR LINE**

VICTOR hardfacing alloys save you time and money with faster application, smoother deposits, longer wear!

See your VICTOR dealer now . . . get the facts, and you'll get VICTOR!

VICTOR for welding

Profitable dealerships open; inquire now!

For Manual Application

THIS HARD-FACING ROD	FOR THESE CONDITIONS	FOR THIS EQUIPMENT	APPLI-CATION
VICTORTUBE	Severe abrasion	Scarifier teeth, dredge cutter blades, posthole augers, oil field tools, ditcher teeth	Acety. AC-DC Elec.
VICTORTUBE "SPECIAL"	Abrasion, severe impact	Oilfield bits, rock bits	Acety. only
VICTOR TUNGSMOOTH	Thin cutting edges	Coal cutters, brick augers, pug mill knives, screw conveyors, farm tools	Acety. AC-DC Elec.
VICTORITE	Earth abrasion or sliding friction	Plowshares, cultivators, steel mill guides, cement chutes, shaft bearings, rolling mill guides	Acety. AC-DC Elec.
TUBE VICTORITE	Abrasion, impact	Plow points and farm tools	Acety. AC-DC Elec.
VICTORITE 1	Corrosion, heat, abrasion	Saw teeth, carbon scrapers, wire guides, rocker arms, steel mill applications	Acety. AC-DC Elec.
VICTORITE 6	Red heat, impact, corrosion and abrasion	Blanking, forming and trimming dies, cams, hot punches, pump shafts	Acety. AC-DC Elec.
VICTORITE 12	Heat, abrasion, impact	Saw blade inserts and other critical applications	Acety. AC-DC Elec.
VICTORITE CARBON ARC	High abrasion, thin deposit	Plowshares, lister shares, sweeps	Carb. arc Acety.
VICTORALLOY	Abrasion, severe impact	Tractor rollers, dredge pump impellers, bucket lips and teeth, rock crushers, steel mill wobblers, roll crushers	Acety. AC-DC Elec.
VICTORALLOY #1	High abrasion, medium impact	Bucket lips, rock crushers, Muller tires, gyratories	Acety. AC-DC Elec.
VICTORALLOY "A"	Angular shock, extreme impact, build-up	Clutch parts, gears, crusher plates, gyratory mantles, build-up for hardfacing	AC-DC Elec. only
VICTORALLOY "B"	Heavy impact, moderate abrasion	Tractor rollers and sprockets, shovel pads, plates, idlers, etc.	AC-DC Elec. only
VICTORALLOY "C"	High abrasion, moderate shock and impact	Tractor grousers, pressure rolls, crusher segments, roll crusher teeth	AC-DC Elec. only

Also VICTOR Bulk Metals, VICTORITE Plow Point Bars, and VICTOR Super-Titan Blasting Nozzles

For Automatic Application

THIS TYPE	FOR THESE CONDITIONS	ON THIS KIND OF EQUIPMENT
VA #1	Abrasion, medium impact	Crusher rolls, crushers, gyratory crushers
VA #2	Abrasion, impact, Multi-pass application	Steel mill applications
VA #3	Abrasion, light impact	Mill guides, crushers, dredge bushings
VA #4	Multiple layer build-up	Tractor rails, crane wheels, general build-up
VA #5	Heavy impact, abrasion	Tractor rollers, idlers, mine car wheels, sheave wheels
VA #6	Medium abrasion, high impact	Crane wheels, drums, roll necks
VA #7	Abrasion, high impact	Build-up for hardfacing
VA #8	Abrasion, medium impact	Dozer bits, roll crushers, scraper blades
VT #60	Extreme abrasion	Tool joints, grader blades, scraper blades, augers

VICTOR EQUIPMENT COMPANY

ALLOY ROD AND METAL DIVISION

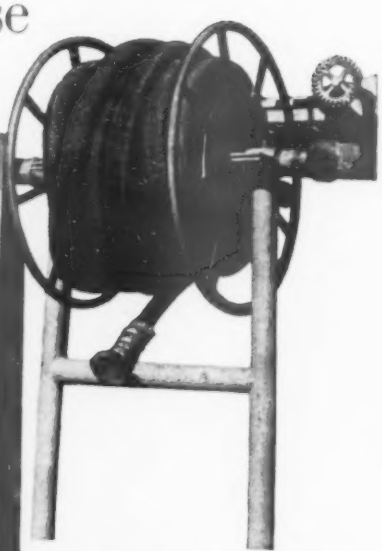
11440 So. Alameda St. • Los Angeles 59

(Also Mfrs. of welding & cutting equipment, blasting nozzles)

844 Folsom St., San Francisco 7 3821 Santa Fe Ave., Los Angeles 58

H-11

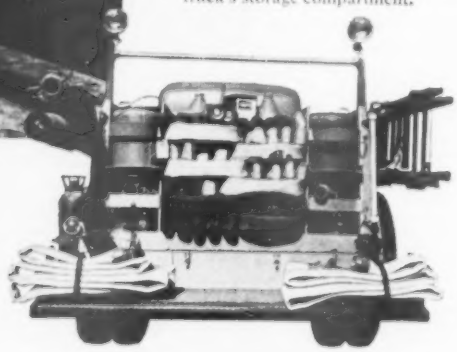
Maintenance men and firefighters rely on U. S. Rubber Hose



Above is a "U. S." neoprene-covered fire hose in a refinery. It is resistant to sun, chemicals, oil, abrasion and mildew. It has the popular fog nozzle.

(left) **"U. S." hose** used for fire fighting as well as general wash-down purposes.

(below) **U. S. Matchless Carbolized** fire hose can handle 500 gallons per minute. Note how its flexibility allows it to be folded into the truck's storage compartment.



Many a leading modern refinery depends on "U.S." hose of several types to help protect against fire. Each hose is specially designed and built to handle a definite set of working conditions. Highest grade materials, scientifically compounded rubber, uniformity of construction, skilled workmanship – these are the secret of "U.S." hose superiority. For extra special circumstances, "U.S." engineers will develop hose to meet your requirements. Write to address below.

PRODUCTS OF U.S.RUBBER SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

MECHANICAL GOODS DIVISION • ROCKEFELLER CENTER, NEW YORK 20, N. Y.

SHEFFIELD

BOLTS and NUTS

There's a big difference in bolts. You can count on a good tight fastening with long-pull holding power if you specify Sheffield Bolts and Nuts. Here's why:

Sheffield's Statistical Quality Control governs every step of manufacture, beginning with the making of the special analysis Sheffield bolt steel. Inspection data is recorded at each stage. This data is analyzed by statistical methods similar to those used in aircraft production. Constant control of quality is assured beyond a doubt.

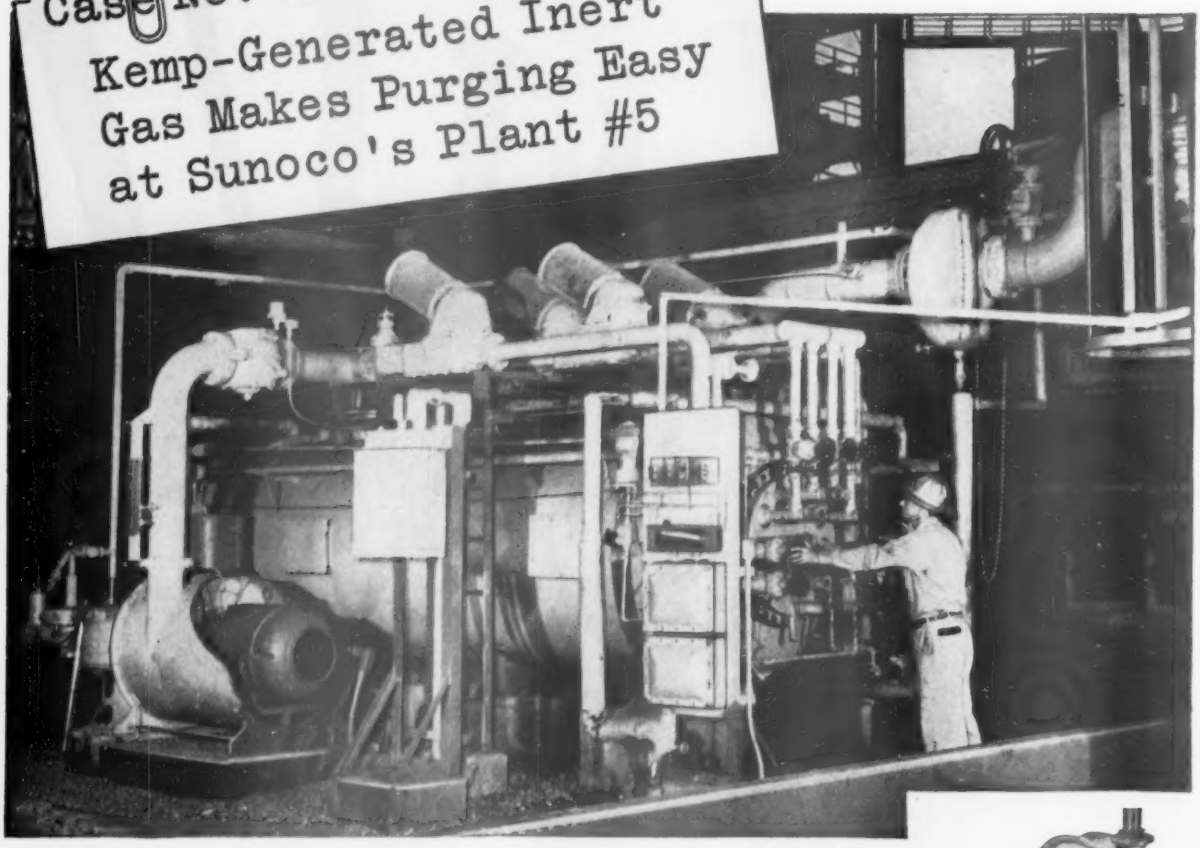
Sheffield is ready to make fast delivery of your bolt and nut needs—in thousands of standard types and sizes, or specialized fasteners made to your specific needs. We'll save you valuable time. Get in touch with us now.

Sheffield-Made and Quality-Controlled from Furnace to Finished Product

SHEFFIELD
STEEL
CORPORATION
HOUSTON KANSAS CITY
TULSA
SUBSIDIARY OF ARMCO STEEL CORPORATION

Case No. 57

Kemp-Generated Inert Gas Makes Purging Easy at Sunoco's Plant #5



How Sun Oil's "Magic Mill" at Toledo operates with 'round the clock safety

There's no *one* word that strikes terror in the hearts of oilmen everywhere more quickly than F-I-R-E! To combat this threat at the Sun Oil Co.'s giant refinery at Toledo, Ohio, constant vigilance, checks and inspections are the answer. And the liberal use of inert gas for purging pipelines, tanks and crackers is essential to this safety maintenance.

Kemp selected to do the job

When plans called for *doubling* plant production in 1950, a new Kemp Generator (see above) was installed to insure adequate inert gas production. Fast-starting, easy-to-operate, this Kemp unit more than filled the bill. Today tanks and lines are periodically purged for inspection and cleaning *as often as needed*. And thanks to its 60,000 cu. ft. per hr. Kemp Inert Gas Generator, Sunoco enjoys *exact analysis* inert production that meets all its purging requirements.

Let Kemp help you, too

If you have a purging or blanketing problem, why not let Kemp Engineers give you the same helpful advice used so profitably at Sun Oil's Toledo refinery. It costs you nothing to investigate. And it may save you money. Find out how Kemp's wide range of dependable, low-cost Generators (complete with the latest fire checks and safety devices) offer you the best way to solve your problems.

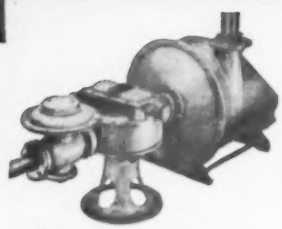
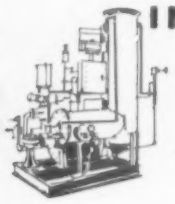


Photo above shows close-up view of Kemp Industrial Carburetor, the heart of every Kemp installation. Assures complete combustion... without waste, without tinkering. Reduces installation costs, simplifies maintenance.

For more complete facts and technical information, write for Bulletin I-10 to: **C. M. KEMP MFG. CO., 405 E. Oliver Street, Baltimore 2, Maryland.**

KEMP OF BALTIMORE

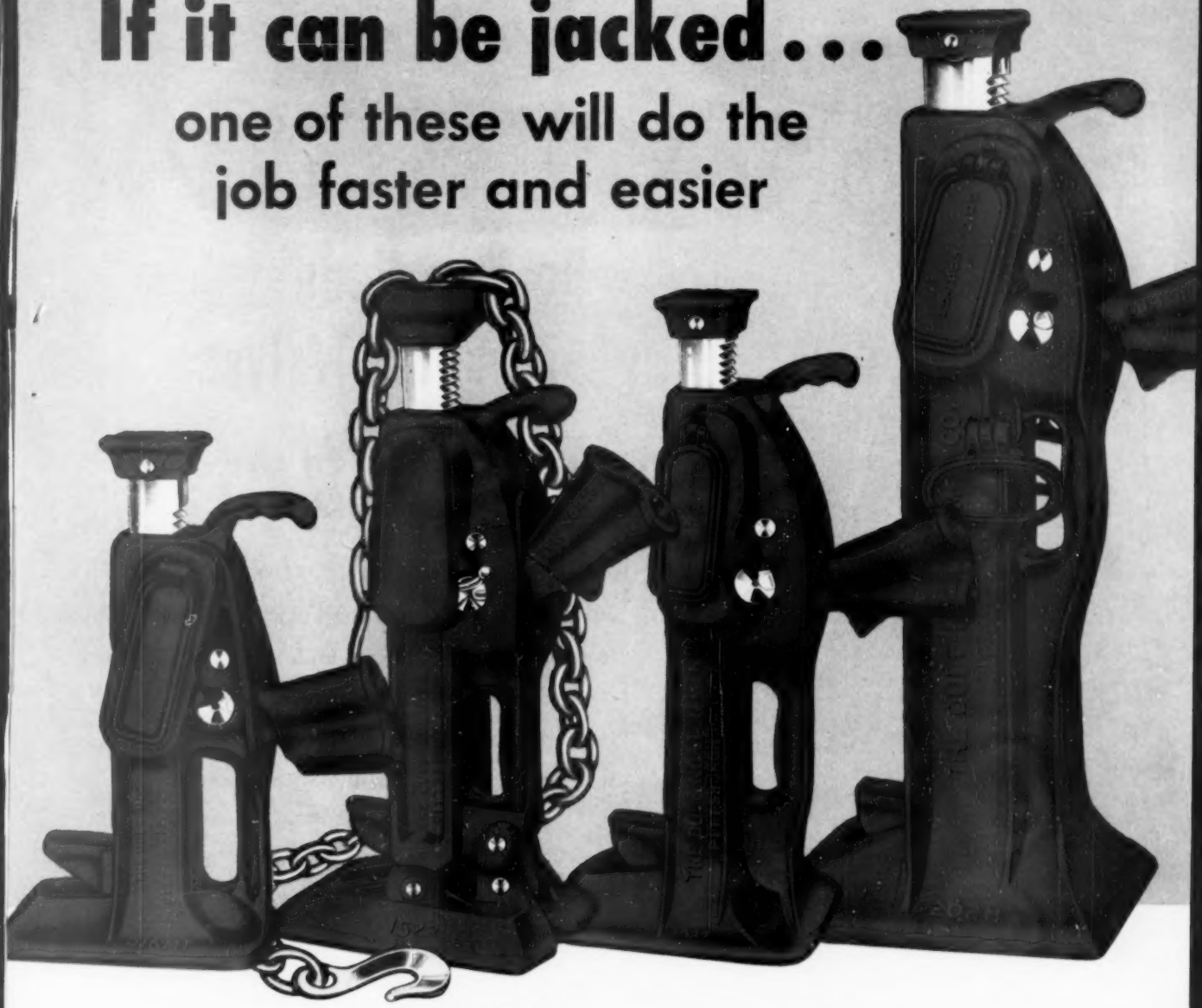


INERT GAS GENERATORS

CARBURETORS • BURNERS • FIRE CHECKS
METAL MELTING UNITS • ADSORPTIVE DRYERS • SINGEING EQUIPMENT

If it can be jacked...

one of these will do the job faster and easier



No. 516-MT	"The Roustabout" No. 1523	No. 1022	No. 2028
5-TON CAPACITY	15-TON CAPACITY	10-TON CAPACITY	20-TON CAPACITY

For Better Service—Duff-Norton maintains complete stocks of jacks of all kinds—ratchet, screw and hydraulic—in *the only jack warehouse in the oil country* at 209 West First Street, Odessa, Texas. Phone 6-3021.

The job will always go faster and easier when you use the correct jack for the job at hand. These rugged, dependable, powerful Duff-Norton jacks are designed and built for years of trouble-free service.

All contain the exclusive, patented, Duff-Norton spring mechanism that assures safe, positive action in lifting or lowering. All have sturdy foot lifts for getting a toe-hold under low set loads.

All are available from your favorite supply store. For complete information on these and many other Duff-Norton Jacks, write the world's oldest and largest manufacturer of lifting jacks for special Oil Field Jack Bulletin, AD 19-B, the Duff-Norton Manufacturing Co., P. O. Box 1889, Pittsburgh 30, Pa. Canadian plant—Toronto 6, Ont.

DUFF-NORTON *Jacks*

"Giving Industry a Lift Since 1883"

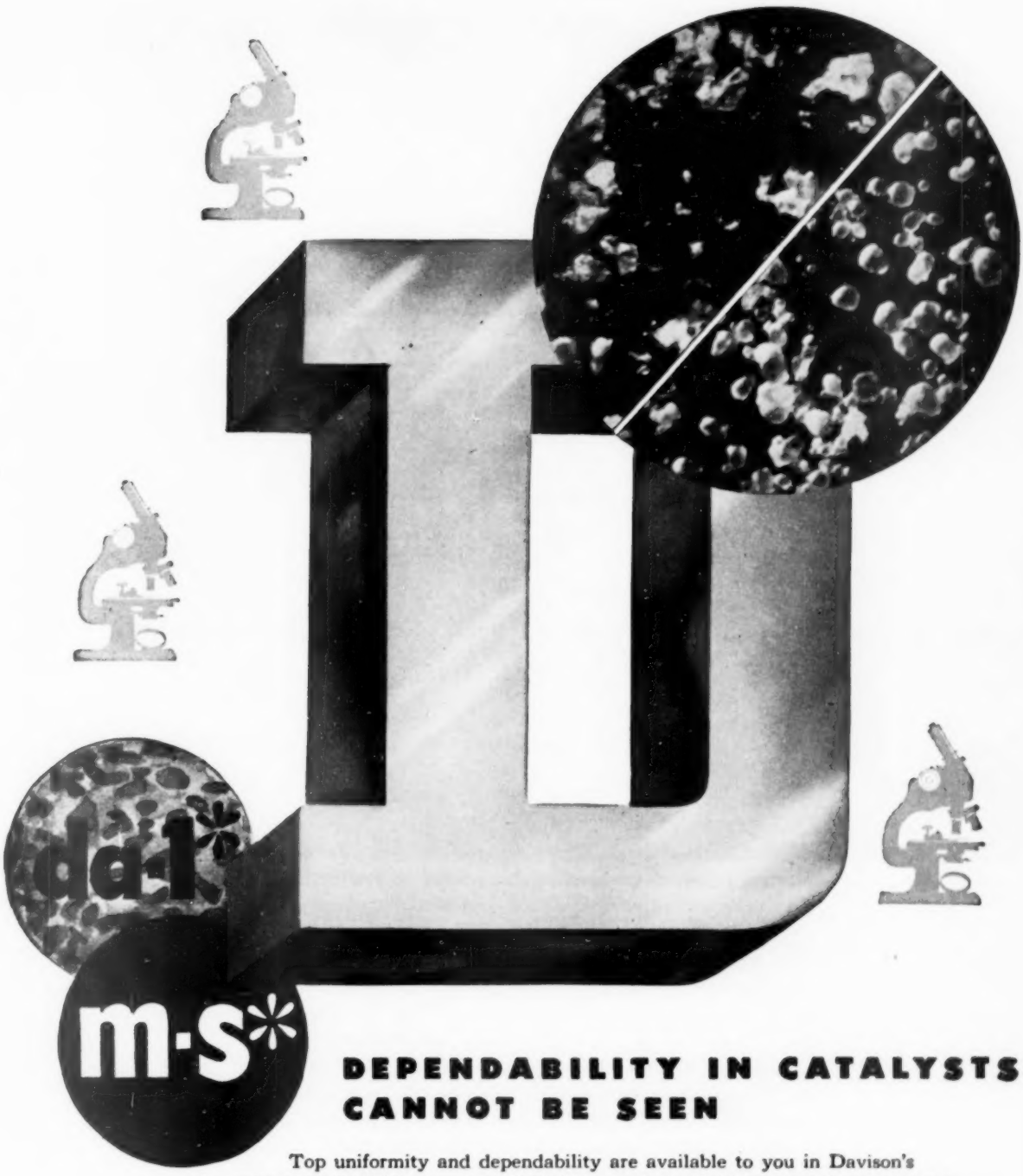
Do You Need High Pressure Valves

. . . or are you on the "minus side"?

CHAPMAN CAST STEEL VALVES are made in gate, globe, and check types . . . to handle the most severe high-pressure, high-temperature services, as well as sub-zero operations. These valves are made to ASA and API ratings in all sizes. And on the special side, Chapman has everything needed to develop alloys and designs for *any* requirement. Do *you* have Catalog 20?

THE CHAPMAN VALVE MFG. CO.
INDIAN ORCHARD, MASSACHUSETTS

YEAR BY YEAR, CHAPMAN WRITES NEW CHAPTERS IN METALLURGY AND FLOW-CONTROL



DEPENDABILITY IN CATALYSTS CANNOT BE SEEN

Top uniformity and dependability are available to you in Davison's microspheroidal (M-S*) or ground (DA-1*) synthetic fluid-type cracking catalysts. The accompanying photomicrographs show the physical characteristics of the DA-1 and new M-S catalysts produced in Davison's Cincinnati plant. Uniform physical and catalytic characteristics result from Davison's modern facilities and years of technical experience and research Experienced Davison Field Service Engineers—complete laboratory facilities—are all part of Davison Dependability—Dependability with the big "D".

*T.M.T.D.C.C.

Progress Through Chemistry

THE DAVISON CHEMICAL CORPORATION

Baltimore 3, Maryland

PRODUCERS OF: CATALYSTS, INORGANIC ACIDS, SUPERPHOSPHATES, PHOSPHATE ROCK, SILICA GELS, SILICOFLUORIDES AND FERTILIZERS

HALLIBURTON'S POZMIX CEMENT

MOST DESIRABLE QUALITIES FOR IMPROVED CEMENTING at reduced cost...

Well over a million sacks of Pozmix have been used since it was introduced by Halliburton. Experience shows that it produces consistent results in improved cementing.

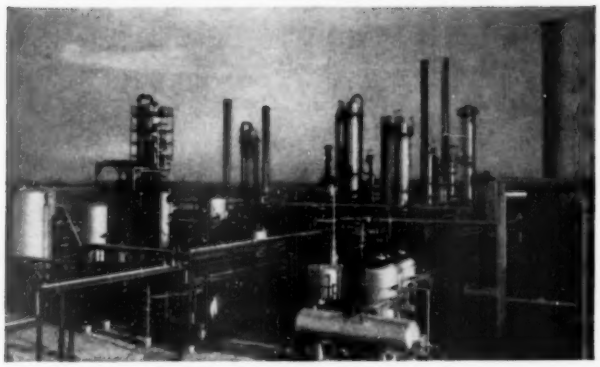
Pozmix is Halliburton's exclusive blend of Portland cement and a natural pozzolan. It has proved to have several desirable features: excellent perforation characteristics, low permeability, resistance to corrosion, good pumpability, and low cost.

The pozzolan combines with calcium hydroxide, a product of cement hydration, to form insoluble compounds with cementing properties that contribute to both strength and water tightness. It reduces the shattering effect of gun perforating, contributing to more water-free production.

There's no doubt that Pozmix is a major contribution to improved oil well cementing. So take advantage of its desirable qualities on your next job – get better cementing at reduced cost. Just phone your local or district Halliburton office. Or contact Halliburton Oil Well Cementing Company, Duncan, Oklahoma.

HALLIBURTON

CEMENTING SERVICES



Oh, I see

OIC Valves on the line at Frontier Oil Refining Company, a new refinery at Buffalo, New York.

. . . they're using our valves at Frontier Oil Refining Company

Each valve shown here has qualified for its place in this line because it meets the oil industry standards of modern design, materials, construction and rigid inspection.

Traffic in gallons demands this careful screening. In the long run, it means lower maintenance costs and longer service for OIC Valve users. It's another reason why OIC Valves have gained ready acceptance at Frontier Oil Refining Company and other important oil industry installations.

THE OHIO INJECTOR COMPANY • WADSWORTH, OHIO

OIC FOUNDED 1883

VALVES | **FORGED & CAST STEEL, LUBRICATED PLUG, BRONZE & IRON**

POSITIVE DUST PROTECTION

for Small Engines and Compressors

NEW AMERICAN TYPE FS INTAKE AIR FILTER NOW AVAILABLE IN 50 TO 800 CFM CAPACITY RANGE.

Clean air is no longer reserved just for the "big boys"! The new American Type FS filter was designed with only one group in mind—those small stationary and portable engines and compressors of 50 to 800 cfm capacity.

Starting from "scratch", AAF engineers have built into the Type FS the five filter features essential for this service—(1) high cleaning efficiency, (2) large dust holding capacity, (3) easy maintenance, (4) simple installation *in any position or location,* (5) inexpensive media replacement.

Filtering Media "Combat Proved"

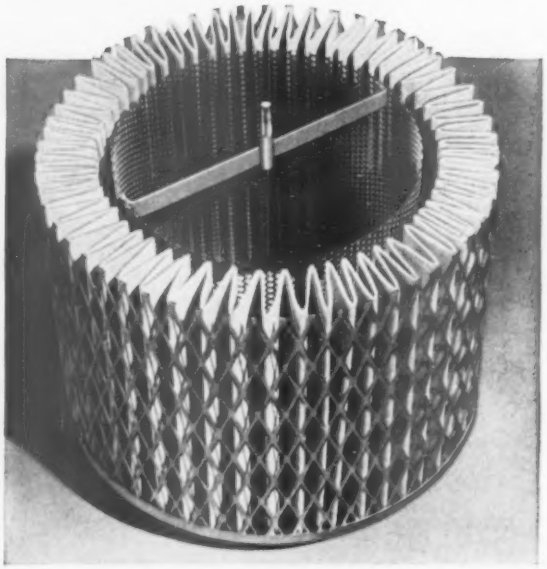
The filtering media used in the Type FS is a rayon flock—the same as selected for combat plane carburetor intake filters because of its light weight and efficient dust removal. The flock, which is bonded on a galvanized woven screen, may be cleaned quickly by washing in gasoline or any other solvent.

Operates Either Dry or Oilcoated

The Type FS may be operated either dry or oilcoated. When oiled its high cleaning efficiency is comparable to that of the dry filter and its dust holding capacity equal to that of a viscous type filter.

Uniform Efficiency

Whether operated oiled or dry, the Type FS filter's efficiency in dust removal is uniform over its entire life. With cleaning efficiency constant, full protection is assured at all times.



View of a Type FS filter with top section removed. The flocked screen filtering media is accordion pleated to provide maximum surface area. Inner perforated screen baffle serves to equalize air flow and protect against backfire.

Available in 7 Sizes

The Type FS is made in seven sizes, giving a capacity range from 50 to 800 cfm. A weather shield is available for outdoor installation as protection against rain and snow.

Write today for Bulletin No. 135 containing complete data on the new American Type FS—the filter for small engines and compressors with a big capacity for work.

AAF

American Air Filter

COMPANY, INC.

444 Central Avenue, Louisville 8, Kentucky • American Air Filter of Canada, Ltd., Montreal, P. Q.

Do you have this MARVEL Inverse Oiler

on your { GASOLINE / BUTANE / or / DRY GAS } engine?

then you should use this MARVEL MYSTERY OIL in the Oiler!

Here's a carefully engineered pair to improve performance of any engine . . .

The *Marvel Inverse Oiler* is designed to feed *Marvel Mystery Oil* in exact proportion to engine speed and load. Prevents excess wear on valve stems and guides . . . keeps upper piston rings free to move in their grooves . . . retards ring flutter . . . and cushions ring pounding which can result in ring breakage. In addition, *Marvel Mystery Oil* reduces cylinder wall wear, and gives assurance against valves sticking. Remember, it is *the oil* which must do these things and only *Marvel Mystery Oil* is blended for this purpose and for this oiler. Over 30 years of exceptional performance.

This Chart shows the proper setting for constant load engines

BRAKE H. P. AT BELT	NAT. GAS CU. FT. PER HOUR	BUTANE GALLONS PER HOUR	GASOLINE GALLONS PER HOUR	M. M. OIL DROPS PER MIN.	M. M. OIL HOURS PER QUART
10	115.	1.07	1.12	4	228
15	172.5	1.60	1.68	6	152
20	230.	2.14	2.24	8	114
25	287.5	2.67	2.80	10	91
30	345.	3.21	3.36	12	76
35	402.5	3.74	3.92	14	65
40	460.	4.28	4.48	16	57
45	517.5	4.81	5.04	18	50
50	575.	5.35	5.60	20	45
60	690.	6.42	6.72	24	38
70	805.	7.49	7.84	28	32
80	920.	8.56	8.96	32	28
90	1035.	9.63	10.08	36	25
100	1150.	10.70	11.20	40	22
120	1380.	12.84	13.44	48	19
140	1610.	14.98	15.68	56	17
160	1840.	17.12	17.92	64	14
180	2070.	19.26	20.16	72	12
200	2300.	21.40	22.40	80	11
225	2587.5	24.00	25.20	90	10
250	2875.	26.75	28.00	100	9
275	3162.5	29.42	31.10	110	8
300	3450.	32.10	33.60	120	7

EXAMPLE:—If you use 805 cu. ft. of dry gas, 7.49 gallons of butane or 7.84 gallons of gasoline, your H.P. is about 70, so adjust oiler to feed 28 drops per minute. You will then receive about 32 hours per quart of MARVEL MYSTERY OIL.

If engine load increases after setting for normal load, oiler will automatically increase its feed, or decrease its feed when load is lessened.

When more than one oiler is used

To determine drop count per oiler when more than one oiler is used on an engine—divide recommended drop count by number of oilers.

NOTE: Guarantee on oiler is void if any other oil than MARVEL MYSTERY OIL is used therein. Some *engines* also carry this guarantee policy.

See Your Local Jobber or Oil Well Supply House

EMEROL MFG. CO. Dept. 373, 242 West 69th Street, New York 23, N. Y.

THINGS ARE MOVING FAST IN CANADIAN OIL

. . . and The Canadian Bank of Commerce can help you to make the most of today's opportunities.

Our Petroleum & Natural Gas Division at Calgary is equipped to furnish authoritative information on all phases of the Canadian oil and gas picture. We welcome consultation with oil men on any specific financial problems.

A network of over 140 branches of this Bank throughout the sedimentary basin of Western Canada rounds out the progressive, productive service we provide to the oil and allied industries.

Address inquiries to Petroleum and Natural Gas Division The Canadian Bank of Commerce 809 Centre Street, Calgary, Alberta

The Canadian Bank of Commerce

Head Office — Toronto
25 King Street West
New York • San Francisco • Los Angeles
Seattle • Portland, Ore.
and more than 640 Canadian Branches

They Say—

"Jack-of-Many-Trades"

"Granting that solar heating and atomic power do arrive on the scene more prominently, and are available at a cost that is relatively more attractive than petroleum fuels, I foresee no need for the petroleum engineer to become disturbed.

"Since he is of necessity a 'Jack-of-Many-Trades' in an engineering sense, what industry would be better equipped to move into these new spheres of fuel supply than this far-seeing petroleum industry that we are all a part of. Our industry has attained leadership in energy-fuel supply, and unless I miss my guess by a very wide margin, it intends to retain that leadership.

"Since the petroleum engineer borrows his skills and techniques from all fields in the profession—mining, civil, mechanical, chemical, electrical, and all the rest, he is in a position to change his stripes as the occasion requires. . . Therein, I believe, lies the answer to the future of petroleum engineering, and indeed to any branch of engineering."

Frank M. Porter, president of the American Petroleum Institute, in address before the Petroleum Branch of the American Institute of Mining and Metallurgical Engineers, New York.

Don't Produce Alaska Oil

"There is only one power with which there is any likely possibility that we would go to war. That's Russia. Why develop oil fields which are right next door to Russia and which we would have great difficulty in defending?

"Not only would there be slight possibility that in case of such a war we could use the Alaskan oil, but there would be a very large possibility that Russia could.

"Let's keep that Alaskan oil—if there is any oil — in the deepfreeze for awhile."

Editorial in the Tulsa Tribune.

CALENDAR

MARCH

23-April 1 American Chemical Society, annual meeting, Municipal Auditorium, Kansas City, Mo.

24-26 American Power Conference, sixteenth annual meeting, Sherman Hotel, Chicago.

26 American Chemical Society and Sabine Area American Institute of Chem-

CLEAN FLOOR SAFE DERRICK

TYPE "R"

TYPE "S"

TYPE "D"

TYPE "B" RELEASING ATTACHMENT

GUIBERSON *Wire Line Oil Savers*

for Excellent Pack-Off—Clean, Dry Line

3 to choose from—take your choice and know that if it's Guiberson, it's *good!*

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Non-sparking brass bushings and guides throughout . . . long-wearing rubbers . . . finest Guiberson precision construction.

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Positive release for Oil Savers—prevents tool damage.
Easy to attach, pressure won't release it.

Better Be Safe Than Sorry!

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frequency synthesis

analysis simplified...

The Sine Wave Generator is designed as a convenient tool to determine transfer functions of components in automatic control systems and to define the physical properties of existing plants to which control systems are to be added. Data is acquired by the frequency synthesis method in which sinusoidal forcing functions are applied to the system and measurements taken of amplitude and phase shift of the output response. For further information on this or other special purpose devices, or assistance in solving your particular computing-controlling problems, consult LIBRASCOPE.

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THE SINE WAVE GENERATOR

Especially adaptable to pneumatic devices in industrial control systems. It generates sinusoidal motion of adjustable frequency, amplitude and mean position and provides auxiliary electrical signals for phase reference.

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Engineers, physicists and mathematicians in search of interesting assignments, rapid advancement, and job security are requested to write Dick Hastings, Personnel Director.

ical Engineers, joint session, Beaumont, Tex.

27 North Texas Oil and Gas Association, annual meeting, Wichita Falls, Tex.

29-30 International Geological Conference, University of Texas department of geology and Institute of Latin American Studies, Austin.

29-31 Western Petroleum Refiners Association, annual meeting, Plaza Hotel, San Antonio, Tex.

APRIL

4- 6 Texas Independent Producers and Royalty Owners Association, Rice Hotel, Houston.

5- 7 American Society of Lubrication Engineers, Netherland-Plaza Hotel, Cincinnati.

6 New Jersey Section of the Instrument Society of America, sixth annual symposium, Essex House Hotel, Newark, N. J.

6- 8 Petroleum Industry Electrical Association, annual convention and exhibit, Adolphus and Baker Hotels, Dallas.

7 Packaging Institute, annual spring luncheon, Hotel Dennis, Atlantic City, N. J.

8- 9 American Petroleum Institute, Division of Production, Rocky Mountain district meeting, Townsend Hotel, Casper, Wyo.

8- 9 Second annual instrumentation conference, Louisiana Polytechnic Institute, Ruston, La.

12-15 American Association of Petroleum Geologists, Society of Exploration Geophysicists, and Society of Economic Paleontologists and Mineralogists, joint annual meeting, Kiel Auditorium, St. Louis.

13-15 Southwestern Gas Measurement Short Course, University of Oklahoma, Norman, Okla.

14-16 National Petroleum Association, fifty-first semiannual meeting, Cleveland Hotel, Cleveland.

15-16 Sixth National Personnel Conference of the Gas Industry, American Gas Association and Southern Gas Association, Edgewater Beach Hotel, Chicago.

17 Fourth John Zink Process Heating Seminar, John Zink Burner Co. plant, 4401 S. Peoria, Tulsa.

19-21 National Purchasing and Stores Conference, sponsored by the American Gas Association, Atlanta, Ga.

20-23 Distribution, Motor Vehicles and Corrosion Conference, Operating Section, American Gas Association, Mount Royal Hotel, Montreal.

21-23 1954 Southern Industrial Wastes Conference, Manufacturing Chemists Association Southern Association of Science and Industry, and the Texas Chemical Council, Houston.

21-23 Natural Gasoline Association of America, thirty-third annual convention, Baker Hotel, Dallas.

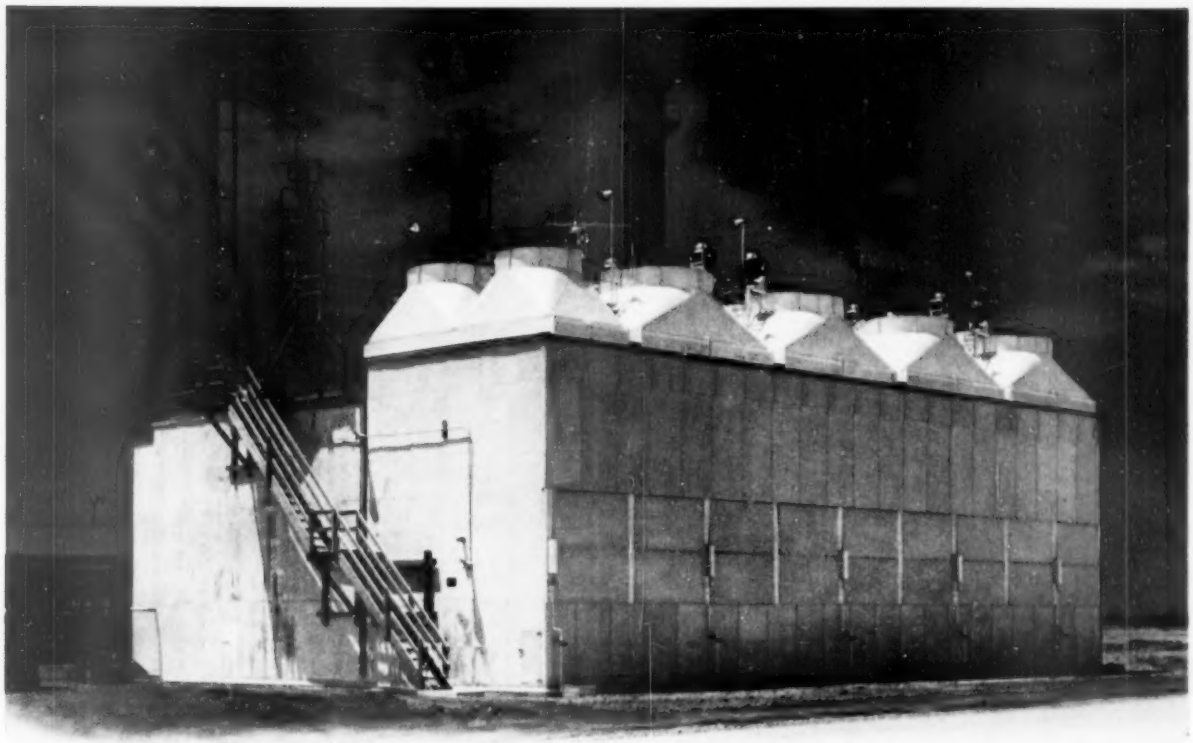
22 Illinois Oil and Gas Association, annual membership meeting, Hotel Emmerson, Mount Vernon, Ill.

26-28 Southern Gas Association, annual convention, Houston.

27 Distillation in Practice, second of an Experience in Industry series, Philadelphia - Wilmington section of the American Institute of Chemical Engineers and University of Pennsylvania, University Museum, Philadelphia.

MAY

2- 4 Independent Petroleum Association of America, midyear meeting, Cosmopolitan Hotel, Denver.



HUDSON *Combin-aire* UNITS

In four years of varied services have proven their advantages

COMBIN-AIRE units are in use for over 20 cooling services, operating on the humid Louisiana coast and the dry plains of West Texas and Oklahoma. Each unit has more than met its performance specifications.

The COMBIN-AIRE is a combination of a comparatively small Hudson water cooling tower with Hudson SOLO-AIRE hot fluid to air exchangers housed in one integral structure. In hot weather air to be used for cooling is reduced to near wet bulb temperature by contact with water near the bottom of the cooling tower. The cooled air is then used for cooling in the SOLO-AIRE units.

In cold weather the use of water is unnecessary. In the above photograph of the integrated structure the SOLO-AIRE units are in the upper foreground and the cooling tower portion is partially obscured in the background. In cold weather the shutters in the foreground may be opened to admit air directly to the SOLO-AIRE units.

Any one or more of the following proven advantages may dictate the use of COMBIN-AIRE for your next cooling problem.

1. **MINIMUM WATER REQUIRED.** No water used in cold weather. No loss from spray or carryover.
2. **NO WATER TREATMENT.** Hard water, sea water or water containing organic matter may be used.
3. **MINIMUM PIPING.** Absence of carryover or condensation allows installation adjacent to other equipment. Auxiliary shell and tube sub-coolers unnecessary.
4. **CLEAN AIR.** Air reaching Solo-aire units is free of dust, sand and insects.

The COMBIN-AIRE unit is protected by United States patents

HUDSON
ENGINEERING CORPORATION

FAIRVIEW STATION • HOUSTON, TEXAS

HUDSON

Top Performance

COOLING EQUIPMENT

For more than two decades HUDSON personnel have developed equipment for heat recovery and heat dissipation. Present day HUDSON cooling equipment has been evolved through the years by constant improvements in design and fabrication.

COOLING TOWERS

COOLING TOWERS

Beauty and utility have been successfully combined in the HUDSON "TP" design. These Top Performance cooling towers embodying new but proven advancements in water cooling design, result in lower installation and operating costs for a given guaranteed performance.

SOLO-AIRE EXCHANGERS

SOLO-AIRE EXCHANGERS

HUDSON Solo-aire exchangers for jacket water cooling, gas cooling, steam condensing and hydrocarbon vapor condensing have found wide use, particularly where suitable cooling water is impossible or expensive to obtain. Even where adequate quality and quantity of water is available there are conditions under which these units have marked advantages over alternative cooling methods. Designs are available for pressures up to 5,000 pounds per square inch.

COMBIN-AIRE UNITS

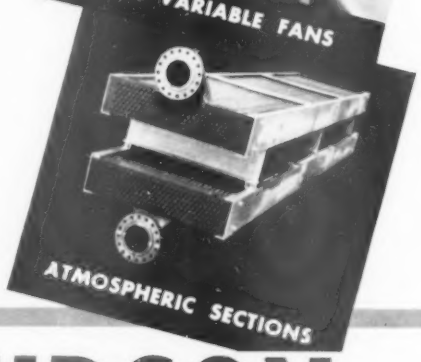
COMBIN-AIRE UNITS

By combining in one structure Solo-aire units with a cooling tower, HUDSON originated the Combin-aire unit. In hot weather, air before use in the Solo-aire units, is contacted with water to reduce both air and water temperature. In cold weather, water use is unnecessary. This device makes possible the use of air for low temperature cooling, allows use of untreated water, minimizes water consumption, and results in capital and operating savings.

AUTO-VARIABLE FANS

AUTO-VARIABLE PITCH FANS

The latest in a long list of Hudson innovations. The auto-variable pitch fan controls cooler outlet temperature through automatic change in fan blade pitch, which in turn changes air volume across cooler tubes. Outlet temperature is closely controlled, and in a typical case horsepower consumption over the year is reduced seventy percent as compared with fixed pitch fan operation.



ATMOSPHERIC SECTIONS

ATMOSPHERIC SECTIONS

These units are for use where water serves as cooling medium. They may be mounted vertically or horizontally, under cooling tower or submerged in water.

UNDIVIDED RESPONSIBILITY—*Complete integration of facilities in selection, design and manufacture of cooling towers, water cooled atmospheric sections, and air cooled exchangers results in cooling systems of minimum first cost, minimum operating cost, and in undivided responsibility.*

HUDSON

ENGINEERING CORPORATION

FAIRVIEW STATION • HOUSTON, TEXAS

3- 5 American Geophysical Union, thirty-fifth annual meeting, National Academy of Sciences, Washington, D. C.

3- 5 Air Pollution Control Association, annual meeting, Patten Hotel, Chattanooga, Tenn.

6- 7 American Petroleum Institute, Division of Production, Pacific Coast district meeting, Statler Hotel, Los Angeles.

9-12 Liquefied Petroleum Gas Association, annual convention and trade show, Conrad Hilton Hotel, Chicago.

10-12 Ninth annual Purdue Industrial Waste conference, Purdue Memorial Union, Lafayette, Ind.

10-12 American Petroleum Institute, Division of Transportation, Products Pipe Line Conference, Warwick Hotel, Philadelphia.

10-13 American Petroleum Institute, Division of Refining, midyear meeting, Rice Hotel, Houston.

14-15 Interstate Oil Compact Commission, General Oglethorpe Hotel, Savannah, Ga.

16-19 American Institute of Chemical Engineers, Springfield, Mass.

17-19 American Petroleum Institute, Division of Marketing, midyear meeting, Cosmopolitan Hotel, Denver.

20-21 Kentucky Oil and Gas Association annual meeting, Lafayette Hotel, Lexington, Ky.

24-26 American Gas Association, production and chemical conference, William Penn Hotel, Pittsburgh.

27-28 Natural Gas and Petroleum Association of Canada, Prince Albert Hotel, Windsor, Ont., Canada.

31-June 5 American Petroleum Institute, Division of Production, midyear committee conference, St. Francis Hotel, San Francisco.

JUNE

2-4 Southern Gas Association, short course in gas technology, Texas College of Arts and Industries, Kingsville, Tex.

3- 4 Pennsylvania Grade Crude Oil Association, thirty-first annual meeting, Hotel William Penn, Pittsburgh.

6-11 Society of Automotive Engineers, summer meeting, Ambassador and Ritz-Carlton Hotels, Atlantic City, N. J.

13-18 American Society for Testing Materials, annual meeting and exhibit, Sherman and Morrison Hotels, Chicago.

17-19 American Petroleum Institute, Division of Production, eastern district meeting, Greenbrier Hotel, White Sulphur Springs, W. Va.

20-24 Canadian Gas Association, Banff Springs Hotel, Banff, Alta., Canada.

JUNE 20-
JULY 4 Seventh annual Conferences on Personnel Administration and Managerial Development, Industrial Relations Section of the California Institute of Technology, California Institute of Technology, Pasadena, Calif.

25-26 Southern Gas Association, transmission management conference, Hotel Adolphus, Dallas.

27
July 1 Petroleum Equipment Suppliers Association, nineteenth annual meeting, Manoir Richelieu, Murray Bay, Que., Canada.

JULY

23 Southern Gas Association, communications conference, Rice Hotel, Houston.

24 Southern Gas Association, dispatchers' conference, Rice Hotel, Houston.

CARCO winches held fast when slippage meant disaster

... on tough Alberta to Vancouver pipeline job

Towing and holding heavy equipment on steep grades is a severe test of a winch brake. On the Model J Carco winch, the automatic, self-energizing brake will hold any load the winch can pull. It takes hold the instant tractor clutch is disengaged. Full braking power comes from high ratio leverage contracting the band on brake drum. Brake unit is reversible, permitting under- or over-wind free-wheeling. Brake release mechanism gives the operator complete load control at all times. The load can be checked at any point and even be "inched" down. Brake is enclosed, protecting it from the elements or external abuse.

Mr. G. T. Guest, Assistant to Project Manager of Comstock Midwestern, Limited, builders of "Big Inch-by-Inch", says, "The job needed Carco winches for towing and holding heavy machinery on steep grades and even for holding men by life lines. Had a single winch failed, men and machinery would have been lost. We found Carco winches equal to everything we asked of them."

On top of hill a Model J Carco winch is winching the Carco J winch and International TD24 shown above up steep slope at Coquihalla Canyon while it, in turn, is winching up clam digger.

You can expect greater value from the leading producer, and get it from Carco, first in winch production. PACIFIC CAR AND FOUNDRY COMPANY, Renton, Wash. Branches at Portland, Ore., and Franklin Park, Ill.

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WINCHES

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"VAREC" Automatic Tank Gauging applies a new principle to a time-tested method of gauge operation that assures dependable accuracy and simplified reading. It will also save time and manpower. There is "VAREC" Automatic Gauging Equipment for high and low pressures and all gauging requirements.

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AUGUST

17-19 Society of Automotive Engineers, Inc., international West Coast meeting, Georgia Hotel, Vancouver, B. C., Canada.
20 Southern Gas Association, natural-gas processing conference, Herring Hotel, Amarillo, Tex.
21 Southern Gas Association, pipe-line operations conference, Herring Hotel, Amarillo, Tex.

SEPTEMBER

7-9 Association of Desk and Derrick Clubs of North America, annual convention, Banff Springs Hotel, Banff, Alta.
9-11 Interstate Oil Compact Commission, Omaha, Neb.
12-16 American Institute of Chemical Engineers, Colorado Hotel, Glenwood Springs, Colo.
15-17 National Petroleum Association, fifty-second annual meeting, Traymore Hotel, Atlantic City, N. J.
16-17 Mid-Continent Oil and Gas Association, Louisiana-Arkansas division, annual meeting, Roosevelt Hotel, New Orleans.
25 Southern Gas Association, compressor-station conference, Captain Shreve Hotel, Shreveport, La.
27-29 Electrical Conference for Petroleum Industry, American Institute of Electrical Engineers, Mayo Hotel, Tulsa.

OCTOBER

2 Southern Gas Association, right-of-way conference, Peabody Hotel, Memphis, Tenn.
4-6 Texas Mid-Continent Oil and Gas Association, annual meeting, Plaza Hotel, San Antonio, Tex.
7-8 California Natural Gasoline Association, twenty-ninth annual fall meeting, Ambassador Hotel, Los Angeles.
9 Southern Gas Association, field production of natural gas roundtable, Rice Hotel, Houston.
11-13 American Gas Association, annual convention, Atlantic City, N. J.
11-13 American Association of Oilwell Drilling Contractors, annual meeting, Biltmore Hotel, Los Angeles.
12-15 Eighth National Chemical Exposition, Chicago Coliseum, Chicago.
14-17 Permian Basin Oil Show, Odessa, Tex.
16 Southern Gas Association, transmission management conference, Rice Hotel, Houston.
17-20 American Institute of Mining and Metallurgical Engineers, petroleum division, fall meeting, Plaza Hotel, San Antonio.
24-26 Independent Petroleum Association of America, annual membership meeting, Mayo Hotel, Tulsa.
26-27 Society of Automotive Engineers, national diesel engine meeting, Statler Hotel, Cleveland.

NOVEMBER

4-5 Society of Automotive Engineers, national fuels and lubricants meeting Mayo Hotel, Tulsa.
8-11 American Petroleum Institute, thirty-fourth annual meeting, Conrad Hilton Hotel and Palmer House, Chicago.

28-Dec.

3 American Society of Mechanical Engineers, Statler Hotel, New York.

DECEMBER

2-4 Interstate Oil Compact Commission, winter meeting, Drake Hotel, Chicago.

"I'm proud to be a Savings Bonds salesman for Uncle Sam . . ."

CHARLES M. WHITE
President
Republic Steel Corporation

"I'm proud to be a Savings Bonds salesman for Uncle Sam and I urge every business executive in the nation to advance the cause of American enterprise in this way.

"Every one of us at Republic Steel is proud of the results of our Payroll Savings campaign: 96.7 per cent of our employees saving systematically from each pay in U. S. Savings Bonds. These results were possible only because all 68,344 of us at Republic were part of an enthusiastic team. We feel that this is the best way we can demonstrate our appreciation of the efforts to have a sound dollar and a stable economy."

• 96.7% of Republic Steel's 68,344 employees — over 66,000 men and women — are enrolled in the Payroll Savings Plan.

• These 66,000 members of Republic's "enthusiastic team," as Mr. White so aptly terms them, are investing more than $16,000,000 per year in U. S. Savings Bonds.

• In addition to building personal security, these men and women of Republic are making a very important contribution to America's "efforts to have a sound dollar and a stable economy."

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In every company with a high percentage Payroll Savings Plan you will find that the president or top executive appreciates the importance of the Plan and what it means to personal and national security. He knows that 45,000 companies have Payroll Savings Plans . . . that 8,000,000 employees of these companies are investing more than $160,000,000 per month in Savings Bonds . . . that the cash value of Savings Bonds held by individuals today is more than 36 billion dollars — and rapidly mounting, thanks largely to the steadily increasing family of Payroll Savers. He is 100% behind his company's Payroll Savings Plan, and everybody in the company knows it. He takes personal pride in watching employee participation grow to 60%, 70%, 80%, or, perhaps, the high 90's.

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TULSA 1, OKLAHOMA

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THE OIL AND GAS
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TULSA, OKLAHOMA

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JOURNALLY Speaking

The Ninety and Nine

IN this, our annual refining issue, there is (along with great gobs of other highly valuable dope) a table listing the operating refineries in the United States and giving the low-down on their capacity, equipment, et cetera.

There are 330 operating refineries in the United States and we have the straight dope on 329 of them, right from the horse's mouth. We asked 'em, and they told us. But the 330th? Shed a tear, for it's a sad tale. The owner-operator of this little teakettle apparently can't read and write. At least he doesn't answer letters. Or telegrams. Or the telephone.

Just like the parable of the shepherd who spent more time looking for his little lost sheep than with those safely in the fold, we really worked on this guy in an effort to make our list absolutely complete. But no dice. Sadly we went to press with "estimated" in this plant's listing.

Outside of that, though, we think this is a pretty good refinery issue.

Frozen Gas

REVOLUTIONARY is the word for the story in the news section of our favorite oil publication this week about shipping natural gas up the Mississippi River by tank barge.

The story speaks for itself, but what intrigues us are the potentialities for future development. Just think what might happen if it becomes common to bottle natural gas up in a deepfreeze and peddle it in containers like ice cream or a frozen meat pie.

No longer will gas producers be dependent on pipe lines. Every producer can install a quick-freeze plant at his well, package his gas in vacuum bottles, and sell it under his own brand name. This, of course, will make the pipe-line industry obsolete, put the Federal Power Commission out of business, and bring new competition to the L.P.G. business.

The threat of foreign competition rears its ugly head. We can vision fleets of reefer ships bringing in a flood of frozen natural gas from Venezuela, the Middle East, and other places where we understand there is a lot of it going to waste, and there will be interminable arguments over whether this foreign gas is supplementing or supplanting domestic production.

Then there's the cooling angle. This frozen gas contains so much absence of heat that a tank of it probably would cool your whole house while warming itself up into gaseous form. A few adjustments to your furnace, and this packaged gas will give you year-around air-conditioned comfort—warmth in winter, coolth in summer. And there goes the nation's zillion-dollar air-conditioning industry into the discard.

Yup, it's revolutionary, all right, Junior, run down to the store and bring back a package of frozen peas and a can of natural gas.

Drums Along the Antilles

THANKS to the oil industry, a new note is being struck throughout the West Indies, according to the National Geographic Society. The note emanates from steel oil drums struck by native musicians. It seems that old drums, discarded by (or swiped from) oil companies, have become an essential part of the instrumentation of Calypso orchestras. With hacksaw and sledge hammer the natives tune the drums by lopping off pieces and pounding in dents until they emit the proper tone for inclusion in what might be called an oil-base xylophone. It is said that in the hands of native musicians the barrels pour out magic melodies and add a modern overtone to jungle music.

The oil industry has enhanced living standards and brought new ways of life to people all over the globe, but, by our personal estimation of Calypso music, this is one of the industry's more doubtful contributions to culture.

—Henry D. Ralph.

"Tube up and forget it" with leakproof Parker *Triple-lok* Fittings

Cramped and crowded, nobody likes to do this kind of a job over again. That's why trouble-free Parker *Triple-lok* fittings were used. Since this hydraulic test stand was completed, it has run over a billion impulse cycles at 3000 psi. without a single leak at any *Triple-lok* fitting.

These flare fittings are absolutely leakproof even under the severest conditions of vibration, high pressures and temperatures. Thousands of destruction tests prove that they will hold pressures that burst the tubing. And, they remain leakproof no matter how often you reassemble them!

Using *Triple-lok* fittings is also the easiest and fastest way to tube up your system even in close quarters. Flared tubing simplifies installation. For fitting make-up, you need only a small wrench because assembly torque is so low.

These fittings meet J.I.C. and S.A.E. standards plus specifications of the A.S.M.E. Code for Pressure Piping.

As a matter of fact, *Triple-lok* is the standard of industry. More *Triple-lok* fittings are used on industrial machinery than any other fitting.

So, tube up and forget it. Use *Triple-lok* throughout your plant. Parker offers the widest range of shapes and sizes available . . . for tubing outside diameters from ⅛ through 2 inches. Ask your distributor for Catalog No. 4300.

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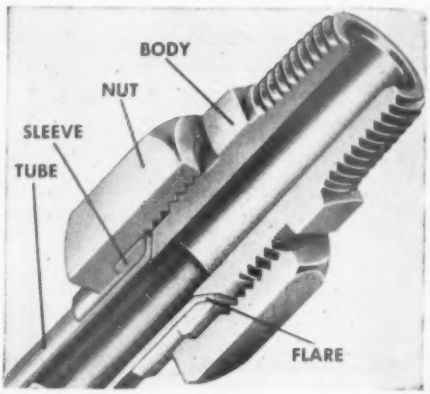
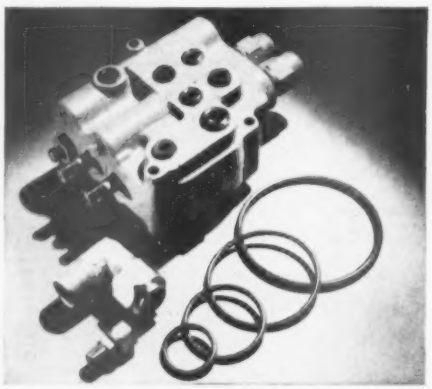


3-piece Triple-lok fittings are stocked in steel, stainless steel, brass, and aluminum alloy —available in other materials on special order.



What other Parker products interest you? Ferulok flareless fittings? Hydraulic control valves? O-rings? Write Parker for information.

CALL YOUR NEAREST DISTRIBUTOR FOR PARKER INDUSTRIAL FITTINGS

Akron 9, Ohio	B. W. Rogers Co. 850 South High St.
Baltimore 13, Md.	Carey Machinery & Supply Co. 3501 Brehms Lane
Baltimore 5, Md.	Whitehead Metal Products Co. 4300 E. Monument St.
Beaumont, Tex.	Standard Brass & Mfg. Co. 705 Milam St.
Birmingham, Ala.	Mill & Textile Supply, Inc. 3128 Third Ave. South
Boston 16, Mass.	A. E. Borden Co., Inc. 176 Brookline Ave.
Bryson City, N. C.	Wallace Co. of N. C. P. O. Box 572
Buffalo 7, N. Y.	Whitehead Metal Products Co. 2128 Elmwood Ave.
Cambridge 39, Mass.	Whitehead Metal Products Co. 281 Albany St.
Cedar Rapids, Ia.	Globe Machinery & Supply Co. 309 8th Ave. S. E.
Charleston, W. Va.	Persingers, Inc. 514 Elizabeth St.
Charlotte 1, N. C.	Industrial Piping Supply Co. 1501 Dowd Rd.
Chicago 14, Ill.	Wallace Tube Co. 1300 Diversey Parkway
Cincinnati 29, Ohio	Williams & Co. 3231 Fredonia Ave.
Cleveland 14, Ohio	B. W. Rogers Co. 1279 East 12th
Cleveland 14, Ohio	Williams & Co. 3700 Perkins Ave.
Columbus 8, Ohio	Williams & Co. 851 Williams Ave.
Dallas 9, Tex.	Metal Goods Corp. 6211 Cedar Springs Rd.
Davenport, Ia.	Globe Machinery & Supply Co. 410 E. Second St.
Dayton 10, Ohio	J. N. Fauver Co. 1534 Keystone Ave.
Denver 2, Colo.	Metal Goods Corp. 2425 Walnut St.
Des Moines 4, Ia.	Globe Machinery & Supply Co. East First & Court Ave.
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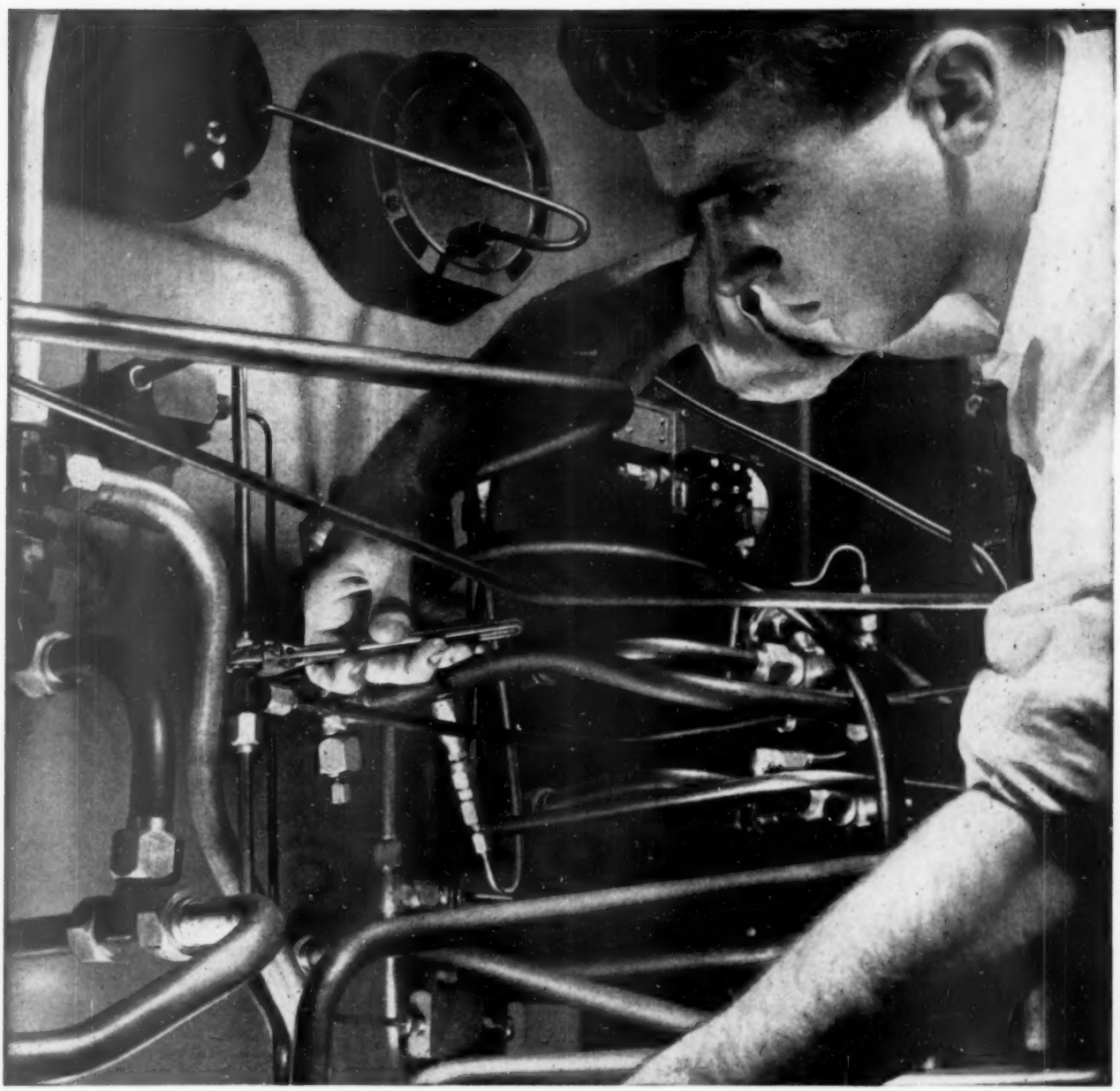
Harrison, N. J.	Whitehead Metal Products Co. 1000 South Fourth Ave.
Houston 3, Tex.	Metal Goods Corp. 711 Milby St.
Houston 1, Tex.	Standard Brass & Mfg. Co. 2018 Franklin St.



Easiest way to install tubing, even in cramped quarters, is to use Parker *Triple-lok* flare fittings. Assembly torque is so low that you need only a small wrench for fitting make-up. The self-aligning sleeve acts as a lock washer, supports the tube, and damps vibration. *Triple-lok* is absolutely leakproof even under high pressures and temperatures.

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Knoxville 5, Tenn.	Leinart Engineering Co. 412 E. 5th Ave.
Los Angeles, Cal.	Haskel Engineering & Supply 721 Broadway, Glendale 4
Los Angeles 12, Cal.	Metropolitan Supply Co. 353 E. 2nd St.
Memphis, Tenn.	J. E. Dilworth Co. 730 South Third St.
Miami, Fla.	Florida Metals, Inc. 4100 N. W. 37th Ct. Hialeah
Milwaukee 3, Wis.	Morman Belting & Supply Co. 522 W. State St.
Milwaukee 4, Wis.	Wallace Companies of Wisconsin, Inc. 838 South 6th St.
Minneapolis 15, Minn.	Vincent Brass & Copper Co. 124 Twelfth Ave. South
New Orleans 12, La.	Metal Goods Corp. 432 Julia St.
Newport News, Va.	Noland Company 27th St. & Virginia Ave.
New York, N. Y.	Nielsen Hydraulic Equipment, Inc. 5 Penn Place, Pelham Manor 65
New York 14, N. Y.	Whitehead Metal Products Co. 303 W. 10th St.
Odessa, Tex.	Snyder Co., Inc. 2604 Kermit Highway
Philadelphia, Pa.	Louis H. Hein Co. 15 W. Lancaster Ave., Ardmore
Philadelphia 47, Pa.	Whitehead Metal Products Co. 1955 Hunting Park Ave.
Pittsburgh 33, Pa.	Williams & Co. 901 Pennsylvania Ave.
Portland 10, Ore.	Hydraulic Power Equipment Co. 2316 N. W. Savier St.
Roanoke 10, Va.	Noland Company 1226 Center Ave. N. W.
Rockford, Ill.	Rockford Tool & Transmission Co. 802 Broadway
Salt Lake City 4, Utah	Pace-Turpin & Co. 726 South Third West
San Francisco 3, Cal.	General Machinery & Supply Co. 1346 Folsom St.
Seattle 9, Wash.	Palmer Supply Co. 222 Westlake North
Shreveport, La.	Standard Brass & Mfg. Co. 1557 Texas Ave.
St. Louis 15, Mo.	Metal Goods Corp. 5239 Brown Ave.
Syracuse 4, N. Y.	Whitehead Metal Products Co. 207 W. Taylor St.
Tampa, Fla.	Florida Metals, Inc. 222 N. 12th St.
Toledo 2, Ohio	Williams & Co. 650 E. Woodruff Ave.
Tulsa, Okla.	Ardun Supply Co. 303 S. Frankfort
Tulsa 3, Okla.	Metal Goods Corp. 302 N. Boston
Export	Mercator Corp. 438 Walnut St., Reading, Pa., U.S.A.

here's the long

...and the short

OF WIRE LINE BRIDGE PLUGS

LONG

Baker Wire Line Bridge Plugs are . . .
LONG on DEPENDABILITY, PERFORMANCE and ECONOMY

Dependable *Baker Wire Line Setting Mechanism* . . . takes less time, *and* sets the plug exactly where you want it.

Reliable, Leak-Proof Pack-Off—Baker Bridge Plugs stay where they are set—no creep or crawl—and produce a pack-off that will withstand any pressure differential, from either above or below the plug, that is safe for the casing.

SHORT

Baker Wire Line Bridge Plugs are . .
SHORT IN LENGTH and in DRILLING-OUT TIME.

The Most Drillable of All Bridge Plugs—The Baker Wire Line Bridge Plug is significantly SHORTER. And, the shorter the plug, the less material to drill up. In addition, the cross-sectional construction of the Baker Bridge Plug is designed to break up under bit action. That's why you are always far ahead in drilling-out time with the Baker Wire Line Bridge Plug.

Cast Iron or Magnesium Alloy—
Take your choice of Baker Wire Line Bridge Plugs made from Cast Iron or from Magnesium Alloy, whichever fits your particular requirements. Either one will hold any pressure differential from above or below the plug, that is safe for the casing itself.

FOR WIRE LINE SETTING
contact any of these leading service organizations:

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For substantial savings in rig time . . .
for dependable bridge plug performance, specify and get the

BAKER WIRE LINE BRIDGE PLUG

on your next plug-back, or combination plug-back and perforating job.

There'll always be a bottom of the barrel

EVER since the automotive age made gasoline the most valuable petroleum product, refiners have been trying to cut down their output of heavy fuel oil—the "bottom of the barrel."

They have made remarkable progress during the past quarter century, reducing the over-all yield of residuals from nearly 50 per cent to less than 20 per cent of crude runs. But the problem still remains because, by and large, resid represents about one-fifth of refinery yields in volume but only about 7 per cent in value, and its price is usually less than the cost of the crude from which it is made.

SO the relentless spurs of competition and profit margin keep pushing refiners toward more advanced technology and more investment in new equipment. Currently there is great interest in a variety of processes to turn resid into something else of greater market value, such as coke or asphalt, or to upgrade it into a lighter liquid fraction.

It is quite probable that before long it will be technically possible to eliminate any resid production from most crudes. A few plants have substantially achieved this already. Some others have reduced residual yields so greatly that their small output finds a ready market at prices which apparently are satisfactory.

But, sooner or later, this trend toward eliminating the bottom of the barrel will run into the law of diminishing returns. The attempt to squeeze the last bit of light ends out of the heavy stuff may incur processing costs greater than the increased market value obtained.

Whether—and when—this point is reached depends, of course, on the relative prices of the various petroleum products. The price of heavy fuel oil depends on the industrial demand for it in competition with coal and natural gas. If prices of these fuels go up while the resid supply goes down, the price of resid may rise until it can be sold profitably as fuel oil.

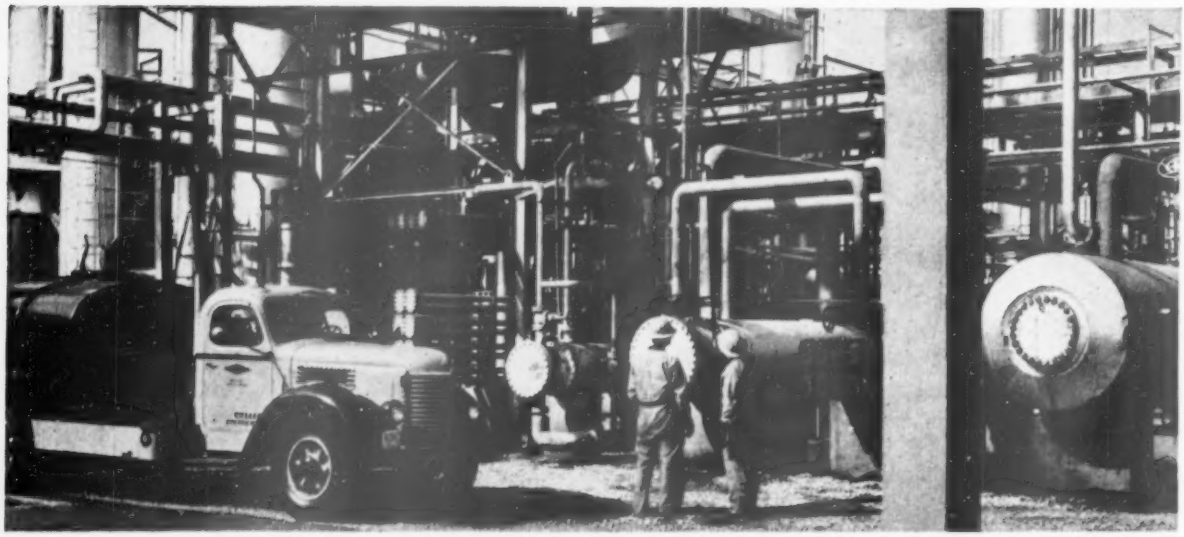
On the other hand there is competition from imports, which currently supply about a quarter of our heavy-fuel-oil market. In seaboard areas these imports may hold down resid prices regardless of other factors, but they have much less effect on fuels competition in inland markets.

SO elimination of resid depends as much on economics as on technology. It is not enough to turn resid into something else unless there is a payout, and it is probable that the point of economic balance will see much bottom of the barrel still marketed as fuel oil.

There is no single solution to the problem, as it varies with each plant's type of crude and local markets. This means that competition will remain intense to develop a variety of processes to upgrade resid at a profit under widely different sets of economic conditions.

CATALYTIC CRACKER OUTPUT INCREASED 6000 BBLS. PER DAY

Slurry exchangers cleaned chemically by Dowell Service in only 12 hours with profitable results



Through-put on a fluid catalytic cracker in a large refinery was reduced because deposits badly fouled the slurry exchangers. Dowell chemically cleaned the shell side of these exchangers in less than 12 hours. As a result of the cleaning, the operator was able to step up the through-put on the cracking unit from 16,000 to 22,000 barrels per day. This increased efficiency also made it possible to postpone a proposed shut-down for a major overhaul of the unit.

On another catalytic cracker, the increased through-put resulting from Dowell Service had an estimated value of $4,300 per day.

All types of equipment on catalytic crackers have been cleaned effectively by Dowell's chemical methods . . . *without dismantling and with a minimum of downtime.* Dowell furnishes trained personnel and all necessary equipment. Dowell engineers apply liquid solvents according to the technique demanded by the job: for example, by filling, spraying, jetting, cascading or vaporizing. These solvents are designed to remove deposits quickly, efficiently and economically. Often equipment may be cleaned while it is in operation.

Call Dowell for assistance on your maintenance cleaning problems. Experienced Dowell engineers will be glad to talk with you. No obligation, of course.

INFORMATIVE PAMPHLET gives description of how Dowell Service saves time and money in cleaning refinery equipment. Call your local Dowell office or write directly to Tulsa, Dept. C-11.

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Over 100 Offices to Serve You with Chemical Cleaning for:

Boilers • Condensers • Heat Exchangers • Cooling Systems
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A Service Subsidiary of
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THIS WEEK... ...IN THE NEWS

PROOF THERE'S OIL IN FLORIDA is this shot of oil-soaked crew members on the 1 Wisehart-State Board of Education in western Dade County. This shot was made during a drill-stem test as a belch of gas blew oil out the top of the drill pipe. The man at right is picking up his safety hat, knocked off by the oil column. The well, drilled by Commonwealth Oil Co. for itself and Gulf Oil Corp. and Coastal Caribbean Oils, Inc., was completed this month on pump, officially opening Florida's second oil field. Official completion gage was 76 bbl. of 21.3°-gravity oil and 96 bbl. of salt water a day. A third field discovery for the state, or a long extension of this new field, last week was being completed by the same group.

REFINING—Journal survey shows construction will continue at a high level during 1954. . . . New crude capacity may not equal that built in 1953, but the excess capacity sought by Government officials for defense purposes will be maintained and perhaps increased. . . . Outstanding trend is expansion of cat reforming, significant because of its potential in leading to still higher octane ratings. . . . ¶Sinclair Refining announces plans for 16,000-bbl. cat reformer at East Chicago, third of its kind . . . will use Sinclair-Baker platinum catalyst . . . Standard of California shuts in 6,000 bbl. daily of heavy-crude production, says refining facilities to process residuals into lighter products already are at capacity operation. . . . Texas Co. begins construction on Platformer and alkylation plant at its Eagle Point refinery. . . .

NATURAL GAS—Unusual project envisions liquefying Gulf Coast natural gas, barging it upriver to Chicago in insulated tanks at atmospheric pressure, selling it first for refrigeration and then as fuel. . . . Barges now under construction, with first shipments scheduled within a few months. . . . ¶Hearings scheduled this week on bills to provide a substitute for Texas' natural-gas gathering tax, killed by the U. S. Supreme Court last week when it refused to review its earlier ruling that tax was unconstitutional. . . . ¶Texas attorney general rules that Railroad Commission cannot require Hugoton field producers to dedicate gas for local use in irrigation projects. . . .

ACTIVITY—Production of crude and lease condensate averaged 6,439,800 bbl. daily for week ended March 13, up 1,925 bbl. daily. . . . ¶Total completions for the week increased 64 wells to 1,029. . . . ¶Wildcat completions gained 24 wells to 191. . . . Rotary rigs operating in the United States totaled 2,598 on March 15 compared with 2,568 a week earlier and 2,463 on corresponding date last year. . . .

TRENDS—Well completions have been above last year for every week but one since the first of the year. . . . Weekly totals have exceeded 1,000 wells for 5 weeks out of the past 10. . . . ¶A slight decrease in average footage indicates more drilling in shallow areas. . . .

EXPLORATION—Proved reserves of liquid hydrocarbons now at all-time peak, according to reserve committees of the A.P.I. and A.G.A. . . . The two groups place reserves at 34,382,750,000 bbl., a net increase of 1,425,545,000 bbl. . . . Figures are derived from new fields, new pools in old fields and revisions of past discovery figures. . . . ¶"Ground thumping" method of geophysical prospecting is now being used. . . . Developed by McCollum Exploration Co., Houston, the new method utilizes a 6,000-lb. weight dropped from a special truck instead of more conventional shot holes. . . . New device is in use in the Edwards Plateau region of West Texas. . . .

GOVERNMENT—Supreme Court turns thumbs down on suits of Alabama and Rhode Island challenging validity of tidelands legislation. . . . Court writes final word in ownership controversy by saying flatly that Congress has right to dispose of offshore lands in any manner it desires. . . . ¶National Petroleum Council opens first 1954 meeting this week with at least three oil industry studies facing it. . . . ¶SEC and Department of Commerce say oil industry equipment expenditures this year will reverse national trend and keep gaining. . . . Oil industry spending will rise 4 per cent while business as a whole will drop the same amount. . . .

PRODUCTION—Vertical fractures hold promise of increasing production in formations of low vertical permeability, A.P.I. production meeting told. . . . New method developed by Continental Oil Co. for vertical fracturing involves injection of viscous fluid containing walnut shells, using a procedure similar to that of conventional fracturing. . . . ¶Stanolind breaks Texas Gulf Coast production-depth record with 13,000-ft. gas-condensate well in eastern Matagorda County. . . .

Refinery Expansion to Continue

- **Addition to basic crude capacity will be below that in 1953, but defense "cushion" will be maintained**
- **Cat reforming boom still under way will increase nation's ability to boost motor-fuel octane ratings**

George Weber

NEW YORK.—United States refiners will continue to build new plant facilities at a high level during the current year.

A close look at the 1954 refining picture in this country reveals that:

. . . Basic crude-processing capacity will show less expansion than last year, but the excess capacity "cushion" desired by the Government for defense purposes will be maintained or increased moderately.

. . . Most significant trend will be substantial expansion of catalytic reforming, which will increase considerably the industry's potential ability to raise motor-fuel octane ratings.

These two over-all trends are clearly revealed in The Oil and Gas Journal's Annual Refinery Survey, beginning this week on page 233. The detailed plant-by-plant survey shows total operable capacity for charging 8,437,314 bbl. of crude per stream day as of January 1, 1954. This represents an increase of more than 950,000 bbl. per stream day over domestic capacity on January 1, 1953—a gain of 12.7 per cent.

A compilation of expansion plans reported by United States refiners indicates that about 350,000 bbl. per stream day will be added to crude capacity before the end of this year. This is substantially lower than the basic boost in crude capacity during 1953. It represents new crude processing facilities projected for completion this year, less older facilities slated for retirement.

On the basis of reports submitted by individual oil companies, it appears that the nation's total crude capacity will reach about 8,790,000 bbl. per stream day by January 1, 1955. This figure is solely an estimate. It includes some construction programs which are slated for completion this year, but may be delayed into 1955. On the other hand it does not include numerous projects for new construction or modification of existing units, which were not sufficiently firm to be reported earlier this year.

Emphasis on cat reforming . . . The annual survey verifies previous indications that 1954 will be a big year for construction of catalytic reformers. A compilation of existing and planned facilities made late last year has proved conservative in both the total capacity as of January 1, and the planned additions during this year. This reflects a higher-than-design capacity rating which many operators are giving to operating units, and a quickening pace in the building program.

It now appears that total cat reforming capacity may reach 700,000 bbl. per stream day by the end of this year, as contrasted with a firm estimate of 600,000 bbl. per stream day, made only 3 months ago.

Outright expansion of cat reforming capacity is only part of the story. This year will bring about a diversification in processes, as illustrated in Table 2. Platforming which represented about 43 per cent of total capacity at the first of this year, will continue its lead with an estimated 50 per cent of total capacity by year's end.

Other processes such as Catforming, fluid Hydroforming and Houdriforming which saw initial commercial application last year, will show further application this year. In addition, five other processes are slated for their first commercial employment in 1954. The performance records to be chalked up by units of these many catalysts and designs will mark 1954 as an important milestone in the evaluation of this advanced refining technique.

Cat cracking trend upward . . . Although the new capacity for catalytic reforming to be added this year will actually exceed that for catalytic cracking, the latter will continue its projected growth. At the first of this year, United States refiners were operating cat cracking capacity equivalent to 33.5 per cent of basic crude capacity, as compared with 32.3 per cent the year previous. The 1954 program indicates that the national average will reach about 36 per cent of crude by January 1, 1955.

This continuing rise in cat cracking capacity relative to crude capacity is an important factor in the improved yields of gasoline and distillate fuels. According to preliminary data reported by the U. S. Bureau of Mines, total gasoline production, including blended natural gasoline, last year represented 50.6 per cent of crude runs to stills, as contrasted with 48.9 per cent in 1952.

Continued addition of catalytic cracking capacity permits the conversion of successively greater fractions of crude each year. Improved techniques for making deeper cuts into the bottom of the barrel for cat cracking feed stocks are accounting for annual reductions in the relative volume of by-product residual fuels which must be marketed for less than the price of the original crude.

On the basis of total crude runs, this yield of residual fuel oil declined from 18.6 per cent in 1952 to 17.6 per cent last year, according to the Bureau of Mines. This decline resulted from expanded cat cracking operations and from increased coking and other residual conversion processes.

The breakdown in catalytic cracking capacity by process type (Table 3) shows little change from the recent past. The various processes employing the fluidized technique continue to account for about 70 per cent of total capacity.

Smaller refiner holding on . . . The smaller refiner appears to be expanding and modernizing at roughly the same rate as the majors. The current program will not appreciably alter the share of the nation's crude capacity operated by the 19 companies which control over 100,000 bbl. per day in their own and subsidiary refineries (Table 4). The greatest change to be registered in 1954 will be the substantial increase in catalytic reforming on the part of the larger companies.

As a class, they have lagged far behind the small refiner in the adoption of modern catalytic reforming. This year will see the installation of many large units by the integrated companies and the wide gap will be substantially closed before the year is over. This program, increasing the potential for higher octane by major refiners, may have a telling effect on the future trend toward higher quality motor fuel in this country.

While the smaller refiner still lags in relative capacity for catalytic cracking based on crude capacity, that percentage is moving upward yearly, with the national trend. It is noted that of the more than 200 refineries operated by companies controlling less than 100,000 bbl. per day, many are very small

skimming plants. These tend to depress the class average regarding catalytic operations. Actually, a large number of other than major refiners maintain capacity in catalytic cracking and reforming which equals or exceeds that of some large companies. This is illustrated by the fact that in some marketing areas, the independents lead the field in gasoline octane.

TABLE 1—UNITED STATES REFINING CAPACITY

	Jan. 1, '53	Jan. 1, '54	Estimated Jan. 1, '55
Crude	7,485,280	8,437,314	8,789,973
Cat. crk.	2,417,850	2,830,052	3,165,847
% of crude	32.3	33.5	36.0
Cat. ref.	136,433	249,092	709,554
% of crude	1.8	3.0	8.1
Poly.	91,146	104,294	134,532
% of crude	1.2	1.2	1.5

TABLE 2—BREAKDOWN OF CATALYTIC REFORMING CAPACITY (U. S. REFINERIES)
(Barrels per stream day)

	Jan. 1, 1954	Estimated Jan. 1, 1955
Platforming	107,192	353,482
Hydroforming (FB)	71,100	71,100
Cycloversion	25,250	25,250
Houdriforming	23,540	28,540
Catforming	20,010	40,712
Hydroforming (Fluid)	2,000	86,300
T.C.R.		37,870
Ultraforming		37,200
Sinclair-Baker		19,000
Sovaforming		9,000
Hyperforming		1,100
Total	249,092	709,554

TABLE 3—BREAKDOWN OF CATALYTIC CRACKING CAPACITY (U. S. REFINERIES)
(Barrels per stream day)

	Jan. 1, 1954	Estimated Jan. 1, 1955
Fluid	1,940,702	2,217,812
T.C.C.	602,910	657,795
Houdry	163,390	163,390
Houdriflow	105,000	108,000
Cycloversion	17,850	18,850
Total	2,829,852	3,165,847

It should be noted that the current survey reports the capacity of all processes as of January 1, 1954. Previous Oil and Gas Journal surveys have included capacity scheduled for initial operation during the current year. Hence the capacity data listed under January 1, 1953 in Table I represents the totals of last year's survey *less* all projects which were not on stream as of January 1, 1953, converted to the common basis of barrels per stream day. It should also be noted that the basis for capacity in these surveys is barrels per stream day as contrasted to the calendar day basis which represents the average daily capacity over the calendar year allowing for shutdown periods for repair and maintenance.

The compilation of construction plans listed in the auxiliary survey indicates the growth of the industry during the next year. Only those projects definitely planned for completion before the end of 1954 are included in the estimate of capacity on January 1, 1955. Several new refineries and expansion projects for existing ones are listed for later completion but are not included in the current year's activities.

TABLE 4—CAPACITY: BIG VS. SMALL REFINERS

	Companies controlling more than 100,000 bbl. per stream day in crude capacity		Companies controlling less than 100,000 bbl. per stream day in crude capacity	
	Jan. 1, 1954	Estimated* Jan. 1, 1955	Jan. 1, 1954	Estimated* Jan. 1, 1955
Number of companies	19	19	173	173
Number of refineries	122	124	208	208
Crude charging capacity	6,769,754	7,070,588	1,667,560	1,719,385
Catalytic cracking capacity	2,409,145	2,712,755	420,707	453,092
Per cent of crude capacity	35.6	38.3	25.3	26.4
Catalytic reforming capacity	151,642	566,174	97,450	143,380
Per cent of crude capacity	2.2	8.0	5.8	8.3

*Includes new capacity scheduled for completion before January 1, 1955.

Industry Briefs

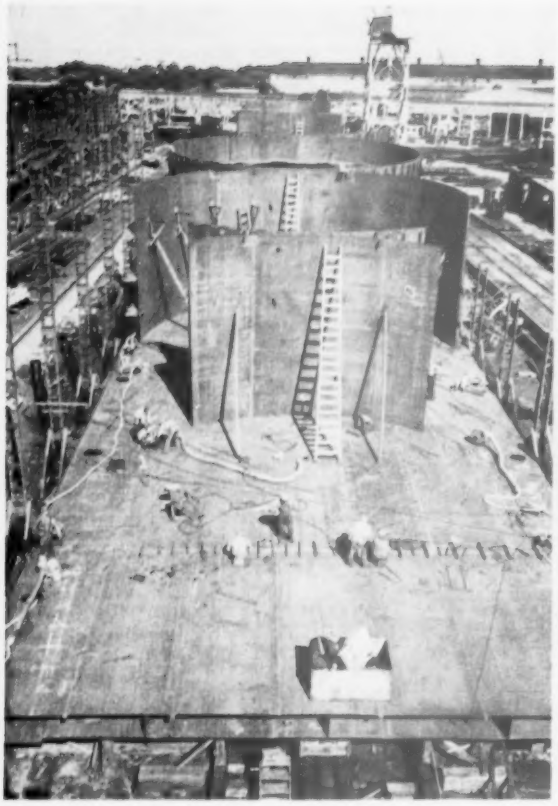
EAST CHICAGO.—Sinclair Refining Co. announced plans last week for construction of a 16,000-bbl. catalytic reformer at its refinery here. The unit will employ the platinum catalyst developed jointly by Sinclair Research Laboratories and Baker & Co. C. F. Braun Co. is contractor. Completion is scheduled for early 1955. The unit is the third of its type planned for this country. The first to go on stream will be a 3,000-bbl. unit at Pure Oil Co.'s Heath, Ohio, refinery, expected to begin operations in May.

RENO, Nev.—Shell Oil Co. last week was coring below 7,362 ft. in its indicated discovery in Nye County. The heavy rush of lease filing here which followed the recovery of oil in Shell's test has quieted. An estimated 3,000,000 acres have been filed on since the strike.

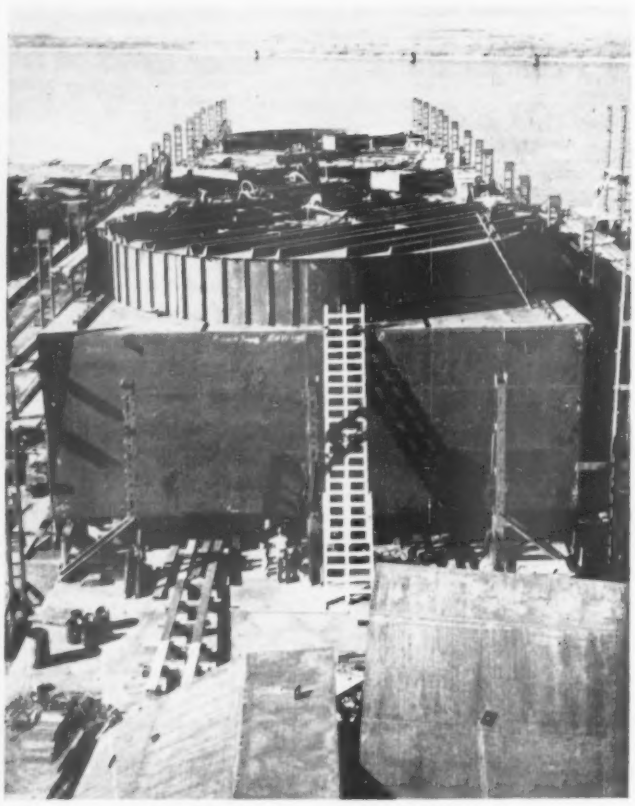
LOS ANGELES.—Offer of Alban Corp. and Church Oil & Gas Co. to buy the capital stock of Fullerton Oil Co. at $71.55 a share is expected to be accepted by the necessary percentage of stockholders. The offer is contingent on deposit of 571,872 shares in a Los Angeles bank not later than April 15. The deal could involve more than $50,000,000. Fullerton owns production in California, Texas, Oklahoma, New Mexico, and Wyoming.

SAN ANTONIO.—The Texas Co. will have to pay the State of Texas nearly $1,000,000 as a result of a decision of the Court of Civil Appeals here. The court upheld the Texas Land Board's claim to mineral rights on 4,000 acres of oil lands in Duval County. It ruled Texaco must pay $666,000 in back royalties, plus $278,000 interest. The company bought the land through Duval County Ranch Co. and drilled more than 40 producing wells.

CHICAGO.—It's better business to be in the oil business than the beer business, the management of Peter Fox Brewing Co. has decided after analysis of their last fiscal year's profit and loss statement. The company earned $231,554 in oil and lost $29,475 in beer, so they plan to divide operations and separate the two. The firm got into oil production in the postwar era, starting with Oklahoma City's large West Edmond boom (Hunton lime). It now owns 125 oil wells in Oklahoma, Texas, Illinois and Indiana.



STORAGE TANKS GO UP on one of the barges which will move liquefied natural gas from the Gulf Coast to Chicago. Tanks will be heavily insulated with balsa wood, hold the liquid at —258° F. at atmospheric pressure.



NEARING COMPLETION is another barge. Each barge unit is 264 ft. long, with a beam of 54 ft. Each will carry five tanks, with each tank having a capacity of 7,000 bbl. or more. Barges are being built by Ingalls Shipbuilding Corp.

Natural Gas to Move by Barge

Novel project will liquefy gas on Gulf Coast, barge it at atmospheric pressure upriver for fuel, refrigeration

W. L. Nelson*

LAKE FOREST, Ill.—Barge movement of natural gas—a unique development in this age of big-inch transmission lines—is scheduled to get under way on the Mississippi River within the next few months.

W. L. Morrison, of Lake Forest, and his associates, of Chicago, are well along on construction of several storage barges at Pascagoula, Miss., which will be used in the operation. The plan is to liquefy natural gas, principally methane, obtained in the Gulf Coast area, load it in insulated tanks on the barges, and move it at atmospheric pressure up the Mississippi and Illinois rivers to the Union stockyards at Chicago.

In Chicago, the gas will be vaporized and used for power generation, with the tremendous amounts of refrigeration obtained in the vaporization process being used in the chilling and cold storage of meat.

Morrison, head of a Lake Forest research organization, and his associates are convinced the operation will be an economic success. In addition to the sale of gas as fuel, use of the refrigeration developed is expected to provide at least 5 cents per M.c.f.

The operation . . . Eight storage barges will ply between Louisiana gas fields and Chicago, as the operation is now planned.

These are to operate on an 11 to 14 day round-trip cycle in two-barge tows. While two are being filled with liquefied gas at the Gulf Coast, two others will be discharging 18,000,000 cu. ft. of gas per day at Chicago. Two and perhaps four other barges will be en route on the river.

A special plant barge carrying the liquefaction equipment will be situated near the source of the natural gas.

Power for the voyage will be cheap, since the towboats will be operated largely off the small amount of natural gas evaporating from the storage tanks, with some liquid being kept in the tanks at Chicago for fuel on the return trip.

At Chicago, special facilities will vaporize the gas at the barge. Warm brine, ranging in temperature from 0° to 25° F., is to be used to evaporate and superheat the natural gas, which, in turn will chill the brine to any specified lower temperature. An intermediate refrigeration agent will be used to

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LIQUEFACTION BARGE is launched at Pascagoula, Miss. Compressors and other equipment are now being installed for liquefying the natural gas. Liquefaction on this barge and vaporization on the storage barges at the destination eliminates the need for storing any liquid product on land.

deliver heat from the brine to the liquefied natural gas.

The liquid gas will be stored during shipment in specially constructed insulated tanks. Balsa wood is being used to insulate the inside of the tanks. It has been under investigation for several years and for the past year or more has been "field tested" in a large-scale tank containing liquid nitrogen at —320° F. Special techniques in applying and fastening the balsa insulation in place have been developed and tested.

Economics . . . Cost of liquefaction equipment, barges, towboats and evaporating equipment is large, but Morrison and has associates consider it well below that of pipe-line transportation.

Studies, they say, have shown that initial construction costs are less than half for barge movement than for major gas-transmission lines. Morrison said a study of one large gas-transmission project showed that the barge, or tanker, method would deliver the same volume of gas with an investment cost considerably less than half that required for a conventional pipe line.

Too, he pointed out, a pipe-line investment is anchored to a particular region of gas supply and must serve a particular marketing area, whereas a liquefied gas barge system can be moved about at will as new supplies are made available or as older fields become depleted. Also, barge operation can be conducted on a relatively small scale, thus reaching out to areas where gas consumption might never justify installation of a gas line.

Refrigeration . . . The growing demand for refrigeration in frozen foods plants, meat packing houses, and other uses, places an entirely new aspect on this field of gas transportation, in the opinion of the developers of the project.

In vaporizing and warming the gas, a ton of refrigeration (288,000 B.t.u.) is available from each 20-22 M.c.f. of gas. The precise value of a ton of refrigeration varies because of many possible situations but the increased value of gas because of the cooling that it can accomplish is at least 5 cents per M.c.f. In some remote locations, or if exceedingly low refrigeration temperatures are required, the value of the gas might be enhanced by even 15 to 25 cents per M.c.f. due to its refrigeration power when in the liquid state. In dewaxing operations in petroleum refineries, for example, the cost of refrigeration ranges from 75 cents to as much as $3.00 to $4.00 per ton, or the equivalent of 3 to 20 cents per M.c.f.

Safety . . . Careful attention has been given to all safety features. The handling of the liquefied gas at atmospheric pressure is basically safer than the handling of high pressure inflammable liquids such as butane or propane. Furthermore, methane tanks will not breathe in as will gasoline tanks, and should liquid be spilled, it will not spread out in thin layers over large areas. Also there is a distinct advantage in that methane vapor when above —150° F. is lighter than air and will not accumulate or be retained in unventilated holds or low spots. Liquefied natural gas can burn, but only at the rate at which heat is supplied for its evaporation. The presence of a fire in close proximity could cause rapid vaporization of any exposed liquid but not of the liquid in the insulated tanks. The liquid gas itself cannot explode.

As in any other storage tank, the gas in the vapor space can explode, if air is also present in the vapor space. The possibility of such an explosion is greatly reduced with methane, however for two reasons:

. . . There is no inward breathing of the tank.

. . . An automatic means has been devised for use in the event that all of the liquid were evaporated from the tank. Remaining natural gas would be purged automatically with carbon dioxide, carried as a solid frozen inert at the bottom of each methane tank.

Normally the vented gas will be used as fuel for the towboat, but in emergencies it would be vented to flare and burned, and in other conditions would be sent to a mixer and diluted with air to a composition too lean for an explosion or combustion. Even the hulls of the barges have been built with two shells so that if one is pierced by a collision, the second shell will permit control of the barge.

Since vaporization will be accomplished on the barge, no liquid gas will be stored on land.

Although the liquefaction of natural gas and its transportation by barge or tanker does not involve any radically new or novel principles, several features of the project required years of development.

Many of these features have been covered by patent applications.

The present barge project is the outgrowth of research by the Morrison organization on deep-freeze and similar activities dating back as far as 1941.

WEIGHT TRUCK which drops 3-ton steel slab to obtain reflected shock waves.

New Seismic Tool

Cheaper recording, better pictures claimed for unusual "ground thumping" method of obtaining subsurface data

William P. Sterne

HOUSTON.—A new method of geophysical prospecting — the weight-drop or "Geograph" method—has been developed by McCollum Exploration Co., Houston.

The method is now being used in the Edwards Plateau region of West Texas by Delhi Oil Corp. and Taylor Oil & Gas Co.

The new exploration idea, the culmination of 15 years of experimental work by McCollum, has been used successfully in the difficult-to-work cavernous-lime areas in several counties in the Edwards Plateau area.

Heart of the system is an "integrating recorder" which takes soundings from a 6,000-lb. weight dropped by a special truck. The recorder integrates the vertically traveling events and tends to suppress the undesirable horizontally traveling events, thus giving a clear picture of the structure being mapped.

Among advantages of the Geograph method, which substitutes the weight for dynamite in obtaining soundings, are:

. . . A better record, because the soundings can be more widely scattered. Also, if one spot is missed, it can be gone over again easily and quickly.

. . . Substantial savings over conventional shot-hole methods. Shot-hole drilling for conventional methods can run as high as $500 per station.

. . . An area can be covered more quickly than in drilling shot holes and setting off explosives.

. . . No set pattern is required in making the soundings, thus affording an unlimited scattering of the shots which results in a better over-all picture of the subsurface conditions.

How it works . . . The "weight truck" contains an A-frame and a special power plant to lift and drop the rectangular steel weight. This piece of steel is 5 ft. long, 3 ft. wide, and 8 in. thick. When not in use, it is carried in a special trailer behind the weight truck.

The weight truck is fitted with a gasoline power plant and the 9½-ft. height of the A-frame is sufficient for adequately sounding the hard-rock country. This height limit prevents the weight truck from becoming top-heavy in the rugged terrain.

The weight falls approximately 9½ ft., being "fired" by remote control from the recording truck, which contains the integrating recorder. The recording and weight trucks are now connected by wire, but the method may be operated by radio if desired.

When the weight is dropped by remote control by the operator in the recording truck, the jar sets up a sound wave which is magnetically recorded on a sound track. Then the weight truck moves 25 to 70 ft. along a line and drops the weight again, by remote-control signal from the recording truck. The weight is never dropped in the same place twice, and the recorder picks up each new sounding on another sound track until all soundings for a given area are made.

While the drops are being recorded, essential correction factors are automatically introduced to compensate for the numerous variables encountered. As a result of these processes, the vertically traveling events are brought into phase coincidence and the energy level is raised by the integrating process. On the other hand the horizontally traveling waves are greatly dispersed as to phase relationship and therefore tend to cancel rather than build up. There is, therefore, a progressive increase in record quality.

As mentioned, there is no set weight-drop pattern in obtaining a picture for a given area. In the hard-rock area of the Edwards Plateau, drops vary from 20 to 200 for any one record.

The weight truck, complete with A-frame, power plant, and auxiliary equipment, weighs 19,000 lb. The truck engine drives the truck through a torque converter.

Not limited to hard rock . . . The McCollum firm points out that the method was developed primarily for hard-rock country, since that is where it is most difficult to obtain good pictures.

However, the Geograph method is not limited to such country and can be used in most any locality, although it has not been tested thoroughly elsewhere. For example, on the Gulf Coast where surface formations are relatively soft, good records have been obtained, usually with fewer drops than are necessary in the Edwards Plateau.

The real advantage of the Geograph is that it obtains a better, clearer picture of subsurface conditions in hard-rock country than does the conventional shot-hole method.

However, another important advantage is the big savings possible in using the method.

The McCollum firm estimates that its integrating recorder method, using the weight-dropping technique, costs only about 50 to 60 per cent of conventional costs for shot-hole drilling and shooting.

Timing important . . . McCollum points out that anybody can go out and drop a weight on the ground to pick up soundings. However, this simple procedure leads to no results of practical value. To be successful the weight-dropping method must be combined with a number of vitally important auxiliary techniques, which are embodied in, and form a part of, the inte-

OPERATOR SITS in chair behind truck cab, operating electrical controls to raise the weight after each drop.

THIS TRAILER serves as a special mount for the 3-ton weight during trips to and from field.

grating-recorder method. These combined techniques form the real "heart" of the system, and are successful in transforming the impacts of the weight into recognizable and factual geophysical data.

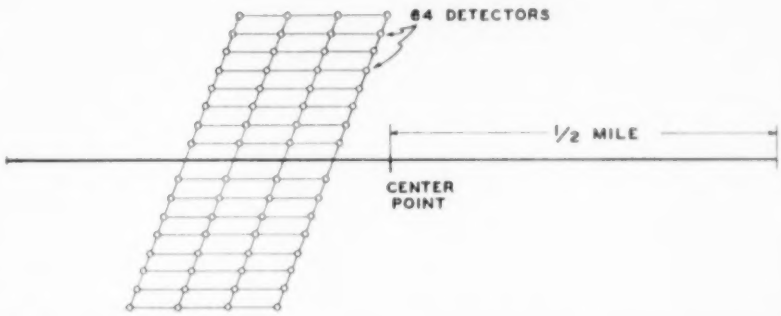
Timing is important in obtaining the true picture of subsurface conditions. The recording instrument controls the dropping of the 6,000-lb. weight to such a degree that even a slight variance in the angle of drop, when the weight truck is not on an even "keel," will be compensated for in relation to previous drops. Numerous other variables affecting the actual time of impact are similarly compensated for by automatic electronic controls. In dispersing the drops over a wide area, geometrical corrections are necessary. These are provided for in the equipment.

An average geophysical crew operating the Geograph setup is made up of 12 to 14 members. Equipment consists of the weight truck, instrument truck containing the integrating recorder; two pickups, a surveyor's unit, a carry-all, and the party manager's car.

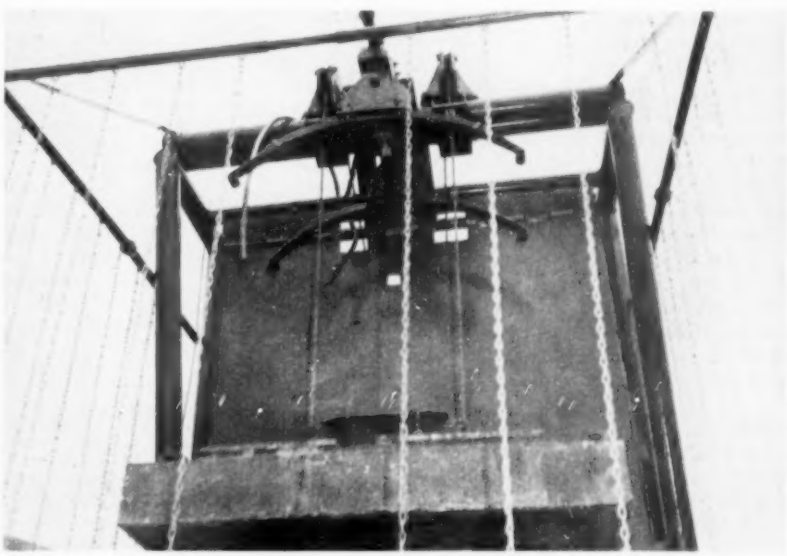
McCollum's equipment, while designed specifically for use with the weight-dropping technique, can be used with regular shot-hole and explosives operations.

Correlations . . . The exploration company says that to date there has been but little comparison of the data obtained by the Geograph with that of conventional shot-hole-and-explosives methods, but that correlation of the Geograph picture compares favorably with existing well logs in the areas tested.

To date there are only two Geograph units in existence and the method has been in a commercial stage only about 8 months.



TYPICAL PATTERN for the weight-drop method. Each "line" is 1 mile long. The weight truck passes through the detectors from left to right, dropping the weight at 25 to 70-ft. intervals for the entire mile course. The truck route can be either on the center line or on either side. The pattern of detectors can be centered on the line or off to the left or right, depending on the geophysicist's choice. In this pattern, rows are 33 ft. apart, with 16 detectors to a row. The pattern extends outward from the center line 225 ft. on each side. If soundings on the first trip of the weight truck are unsatisfactory, another pass is made, but on a line a little to one side of the original line traveled.



HANGING CHAINS warn passers-by of the 3-ton overhead danger. Automobile springs at top halt the weight at the top of its rise.

Reserves Reach All-Time High

A.P.I.-A.G.A. body sets estimated proved reserves of liquid hydrocarbons at 34,382,750,000 bbl.

PROVED reserves of total liquid hydrocarbons rose to a new all-time peak in 1953 with the net increase for the year about in line with the average gain since the end of the war.

The American Petroleum Institute Committee on Petroleum Reserves and the Committee on Natural Gas Reserves of the American Gas Association estimated total liquid hydrocarbon reserves at the end of 1953 to be 34,382,750,000 bbl. for a net increase during the year of 1,425,545,000 bbl.

The Oil and Gas Journal's estimate of total reserves at the end of the year was reported at 34,636,000,000 bbl. or off only 0.7 per cent from the A.P.I.-A.G.A. estimates (January 25, page 137).

Production of liquid hydrocarbons in 1953 amounted to 2,614,554,000 bbl. including 2,311,856,000 bbl. of crude and 302,698,000 bbl. of natural gas liquids. Total production in 1953 was 2.9 per cent greater than in 1952.

If the total increase in net reserves of 1,425,545,000 bbl. is added to production of 2,614,554,000 bbl., a new supply of 4,040,099,000 bbl. is indicated for the year. This new supply resulted from new fields and new pools in old fields plus extensions and revisions for discoveries of past years.

Reported data for total liquid hydrocarbons indicate that the percentage increase in reserves for the year was slightly larger than the increase in production. End-of-the-year reserves increased 4.3 per cent compared with the gain of 2.9 per cent in production of total liquids. The ratio of reserves at the end of 1953 to production during the year was 13.15 compared with 12.96 for the year 1952.

These ratios do not in any way indicate the life of remaining reserves since production rates are controlled by physical factors of reservoirs. They do show that oil finding during the year kept pace with production.

Crude oil . . . Production of crude oil during 1953 set a new all-time record and yet reserves increased from 27,960,554,000 bbl. at the end of 1952 to 28,944,828,000 at the end of 1953. The net increase in reserves of 984,274,000 bbl. was almost twice the gain of 492,523,000 reported for 1952. Pro-

Proved Reserves of Liquid Hydrocarbons

(Thousands of barrels)

	Proved reserves as of 12-31-52	Extensions and revisions	New discoveries*	Production during 1953	Proved reserves as of 12-31-53	Changes in reserves during 1953
Alabama‡	15,635	3,203		1,678	17,160	1,525
Arkansas	403,132	26,640	8,654	30,610	407,816	4,684
California†	4,176,678	442,356	21,110	395,899	4,244,245	67,567
Colorado	317,030	15,321	33,922	36,330	329,943	12,913
Illinois	639,707	26,584	37,015	61,460	641,846	2,139
Indiana	55,704	14,923	3,882	12,236	62,273	6,569
Kansas	1,085,216	94,261	31,124	119,532	1,091,069	5,853
Kentucky	64,723	26,968	10,899	13,159	89,431	24,708
Louisiana†	3,271,196	460,061	124,846	283,234	3,572,869	301,673
Michigan	57,994	15,088	640	12,360	61,362	3,368
Mississippi	409,740	24,903	7,012	36,820	404,835	—4,905
Montana	159,310	62,000	2,766	12,183	211,893	52,583
Nebraska	24,552	5,324	5,109	6,330	28,655	4,103
New Mexico	884,901	316,719	14,913	80,974	1,135,559	250,658
New York‡	52,854			3,771	49,083	—3,771
North Dakota‡	76,203	56,266	1,042	5,240	128,271	52,068
Ohio	29,168	7,714	9	3,706	33,185	4,017
Oklahoma	1,842,526	397,477	43,504	227,047	2,056,460	213,934
Pennsylvania	124,364	180	89	10,782	113,851	—10,513
Texas†	18,041,259	1,057,745	330,863	1,164,005	18,265,862	224,603
Utah	42,456	—3,125	440	1,781	37,990	—4,466
West Virginia	56,740	18,019	207	10,141	64,825	8,085
Wyoming	1,121,812	283,871	8,681	84,695	1,329,669	207,857
Miscellaneous§	4,305	—1	875	581	4,598	293
Total U. S.	32,957,205	3,352,497	687,602	2,614,554	34,382,750	1,425,545

*Only a limited area is assigned to each new discovery, even though the committee may believe that eventually a much larger area will produce; for, in this report, the concern is only with actually proved reserves. †Includes offshore reserves. ‡Crude oil only. §Includes Alabama and North Dakota natural-gas liquids; Missouri, South Dakota, Tennessee and Virginia crude; and Florida crude and natural-gas liquids.

Proved Reserves of Crude Oil

(Thousands of barrels)

	Proved reserves as of 12-31-52	Extensions and revisions	New discoveries	Production during 1953	Proved reserves as of 12-31-53	Changes in reserves during 1953
Alabama	15,635	3,203		1,678	17,160	1,525
Arkansas	352,261	25,639	8,385	28,054	358,231	5,970
California*	3,854,171	409,491	20,802	365,085	3,919,379	65,208
Colorado	305,691	15,321	33,922	35,680	319,254	13,563
Illinois	619,461	26,571	37,010	58,239	624,803	5,342
Indiana	55,535	14,922	3,871	12,200	62,128	6,593
Kansas	916,989	88,162	22,863	114,673	913,341	—3,648
Kentucky	55,565	26,661	10,748	11,319	81,655	26,090
Louisiana*	2,557,530	331,593	108,987	238,455	2,759,655	202,125
Michigan	57,411	14,988	609	12,287	60,721	3,310
Mississippi	358,809	18,383	6,435	33,526	350,101	—8,708
Montana	156,181	62,000	2,766	11,962	208,985	52,804
Nebraska	21,836	4,867	5,047	6,129	25,621	3,785
New Mexico	733,358	138,420	13,112	69,988	814,902	81,544
New York	52,854			3,771	49,083	—3,771
North Dakota	76,203	56,266	1,042	5,240	128,271	52,068
Ohio	27,390	8,131		3,695	31,826	4,436
Oklahoma	1,557,620	360,070	34,220	199,682	1,752,228	194,608
Pennsylvania	121,724			10,641	111,083	—10,641
Texas*	14,916,168	812,189	271,865	1,001,602	14,998,620	82,452
Utah	42,399	—3,125	440	1,777	37,937	—4,462
West Virginia	37,212	2,400		3,000	36,612	—600
Wyoming	1,064,722	288,301	8,681	82,594	1,279,110	214,388
Miscellaneous†	3,829	—3	875	579	4,122	293
Total U. S.	27,960,554	2,704,450	591,680	2,311,856	28,944,828	984,274

*Includes offshore reserves. †Includes Florida, Missouri, South Dakota, Tennessee, and Virginia.

duction for the year increased 55,091,000 bbl. or 2.4 per cent. The net increase in reserves represented a gain of 3.5 per cent. The average annual increase in crude reserves since 1946 has been 1,153,000,000 bbl. Additions in 1953 were only slightly under the postwar average.

The committee report on crude reserves gives a breakdown of additions to reserves during the year. Out of a total of 3,296,130,000 bbl. of crude reserves added in 1953, oil discovered in new fields or in new pools in old fields accounted for 591,680,000 bbl. Extensions of old pools during the year added 1,439,618,000 bbl., and revisions of previous estimates made up the remaining 1,264,832,000 bbl.

The small table shows this breakdown of additions to crude reserves for the years 1947 through 1953. For the full 7-year period, new crude credited to extensions of old pools accounted for 10,935,325,000 bbl. or 48.7 per cent of the total 22,469,679,000 bbl. added to reserves. Discoveries in new pools were credited with only 3,774,608,000 bbl. for the years in which the pools were found.

How estimates are made . . . The committee each year calls attention to the fact that the total assigned to pools discovered during the year is only a part of the crude expected from these pools. The committee explained, "In the case of new discoveries, both of new fields and of new pools in old fields, which are seldom fully developed in the first year and in fact for several years thereafter, the estimates of proved reserves necessarily represent but a part of the reserves which may ultimately be assigned to the new reservoirs discovered each year. The total of new oil through extensions, on the other hand, is comparatively large."

Concerning revisions of past estimates, the committee gave a basis for the additions. "As knowledge of the factors affecting production and reservoir performance becomes available, and these factors are studied, reserves of older fields can be estimated with greater precision and revised accordingly."

In the 7-year period of the small table, revisions of recent years probably include additions to reserves of pools discovered earlier in the period.

Proved Recoverable Reserves of Natural Gas

(Millions of cubic feet—14.65 psi. at 60° F.)

	Reserves as of 12-31-52*	Changes in reserves during 1953: Extensions and revisions*	New discoveries*	Net change in underground storage†	Net prod.‡	Reserves as of 12-31-53*
Arkansas	984,582	252,566	10,983	2,588	39,453	1,211,266
California§	9,340,022	219,205	50,348	50,717	500,945	9,159,347
Colorado	1,164,249	542,852	213,313	0	56,139	1,864,275
Illinois	211,651	48,856	929	0	30,185	231,251
Indiana	36,714	215	2,150	3,901	7,150	35,830
Kansas	14,193,565	466,236	1,587,106	8,457	467,762	15,787,602
Kentucky	1,313,523	42,014	11,160	5,836	71,000	1,301,533
Louisiana§	31,451,614	3,144,349	1,294,440	0	1,431,491	34,458,912
Michigan	254,543	—83,567	250	110,964	6,671	275,519
Mississippi	2,364,060	248,669	156,372	196	200,116	2,569,181
Montana	827,603	—50,924	925	19,493	33,097	764,000
Nebraska	93,958	87,954	12,300	0	12,102	182,110
New Mexico	14,038,889	3,539,961	301,459	78,003	436,102	17,522,210
New York	68,640	—2,688	0	7,414	2,362	71,004
Ohio	731,483	—36,247	5,618	86,408	31,280	755,982
Oklahoma	11,764,829	875,175	427,602	26,238	865,471	12,228,373
Pennsylvania	709,585	9,442	75,450	55,673	98,306	751,844
Texas§	105,732,763	2,591,789	2,868,008	5,466	4,668,400	106,529,626
Utah	283,412	826,517	12,820	0	9,691	1,113,058
West Virginia	1,660,070	88,247	21,850	49,775	166,000	1,653,942
Wyoming	2,321,124	481,122	23,795	5,302	91,712	2,739,631
Miscellaneous¶	169,346	79,612	4,783	0	13,105	240,636
Total	199,716,225	13,371,355	7,081,661	516,431	9,238,540	211,447,132

*Excludes gas loss due to natural gas liquids recovery. †The net difference between gas stored in and gas withdrawn from underground storage reservoirs, inclusive of adjustments and native gas transferred from other reserve categories. ‡Net production equals gross withdrawals less gas injected into producing reservoirs. Changes in underground storage and gas loss due to natural gas liquids recovery are excluded. December production estimated in some instances. §Includes off-shore reserves. ¶Includes Alabama, Florida, Maryland, Missouri, North Dakota, and Virginia.

Estimated Canadian Reserves of Liquid Hydrocarbons

(In thousands of Imperial-gallon barrels which are equivalent to 42 U. S. gallon barrels)

	Proved reserves as of 12-31-52	Extensions and revisions	New discoveries	Prod. during 1953	Proved reserves as of 12-31-53	Changes in reserves during 1953
Crude oil:						
Northwest Territories	26,767			325	26,442	—325
Alberta	1,526,389	143,194	31,731	76,818	1,624,496	98,107
Saskatchewan	124,247	1,609	59,101	2,798	182,159	57,912
Manitoba	2,106	6,360	3,080	656	10,890	8,784
Ontario and New Brunswick†		769	979	313	1,435	1,435
Total crude oil	1,679,509	151,932	94,891	80,910	1,845,422	165,913
Natural-gas liquids*	65,374	91,675	42,323	1,246	198,126	132,752
Total liquid hydrocarbons in W. Canada	1,744,883	243,607	137,214	82,156	2,043,548	298,665

*All natural-gas liquids are located in Alberta. †Not reported December 1952.

Natural-gas liquids . . . Proved reserves of natural-gas liquids at the end of 1953 were estimated by the A.P.I.-A.G.A. committees at 5,437,922,000 bbl. for an increase of 441,271,000 bbl. over the total for the end of 1952. In addition, production during the year set another record with a total of 302,698,000 bbl. Net addition to reserves during the year was 1.46 times production for the year.

In the 7-year period since the end of the war, operators have not only found enough light liquids to meet demands but have made net additions to reserves that were 1.4 times total production for the period. In no year

ADDITIONS TO CRUDE RESERVES

(Thousands of barrels)

	New pools	Extensions of old pools	Revisions of previous estimates
1947	445,430	1,269,862	749,278
1948	396,481	1,439,873	1,958,853
1949	890,417	1,693,862	603,566
1950	564,916	1,334,391	663,378
1951	389,256	2,248,588	1,776,110
1952	496,428	1,509,131	743,729
1953	591,680	1,439,618	1,264,832
Total	3,774,608	10,935,325	7,759,746

NATURAL-GAS TRENDS

(Millions of cubic feet)

	Production	Increases in reserves
1947	5,629,811	5,351,013
1948	6,007,628	7,942,426
1949	6,245,041	6,512,004
1950	6,892,678	5,211,355
1951	7,966,941	8,218,801
1952	8,639,638	5,904,725
1953	9,238,540	11,730,907

since the end of the war has the net addition to crude reserves been as much as production for the year.

Natural gas . . . New records were set in natural-gas production and reserves in 1953. More gas was added through discoveries of new pools than in any other year since the war. Reserves in new pools were estimated at 7,081,661,000 M.c.f. Additions through extensions and revisions amounted to 13,371,355,000 M.c.f., and gas in storage increased 516,431,000 M.c.f.

Net production for the year was reported at 9,238,540,000 M.c.f., up 598,902,000 M.c.f. from 1952. Reserves at the end of the year reached the all-time high of 211,447,132,000 M.c.f. for a gain during the year of 11,730,907,000 M.c.f. This was the largest addition to reserves since 1946.

Part of the large increase reported for "Net Change in Underground Storage" was due to a change in method of reporting. Beginning with the current report, that gas which was native to the reservoir at the time storage injection began is included in the underground storage figure. In past reports, this gas was considered as a part of gas reserves. Changes in underground storage are excluded from net production.

Canada . . . Reserves of liquid hydrocarbons in Canada are presented through courtesy of the Central Reserve Committee of the Canadian Petroleum Association. Total liquid reserves at the end of the year were estimated at 298,665,000 bbl. The committee used the same method of estimating reserves as that used by the A.P.I. committee for the United States.

INDUSTRY AFFAIRS

Polar Inhibitors Work

N.A.C.E. told high-molecular weight organic inhibitors are effective in corrosion control of process equipment

Robert G. Deering

KANSAS CITY. — Polar inhibitors are the solution to many types of corrosion problems connected with refinery process equipment, H. H. Bennett, Socony-Vacuum Oil Co., declared here last week at the meeting of the National Association of Corrosion Engineers.

Proper use of polar organic inhibitors having high molecular weight will result in significant reductions in maintenance and repair costs, he said. Addressing the refinery industry symposium, Bennett said production of process units may be attained for as little as 0.3 mil per barrel of charge.

How it works . . . Action of the high-molecular weight polar inhibitor, Bennett explained, forms a well organized, highly oriented film on the metal surface. The polar end of the inhibitor molecule attaches itself to the metal and the hydrocarbon radical is directed perpendicular to the surface. Thus, inhibitors with high molecular weight and longer hydrocarbon chains give greater film depths and consequently afford more protection.

As the concentration of inhibitor in solution is increased, this film becomes dense enough to impede the movement of metal ions from the surface and hydrogen ions toward the surface, he said. When the film is dense enough to halt all iron flow the corrosion is eliminated. The principal criteria for establishing optimum inhibitor concentration is measurement of p.p.m. of iron in the effluent solution, but test coupons should be used for determining actual corrosion rate.

NEW OFFICERS of N.A.C.E. for the coming year are, left, Arron Wachter, president, and F. L. Whitney, vice president. Wachter is with Shell Development Co., Emeryville, Calif., and Whitney with Monsanto Chemical Co., St. Louis.

Tests of water soluble inhibitor in a one-stage crude distillation unit indicate efficiency is directly related to the pH of the solution and the inhibitor concentration, Bennett said.

Injection of inhibitor was made into the overhead vapor line, near the still, and ammonia was used to vary the stream pH. Two inhibitor concentrations were tested, 4.5 p.p.m. and 9 p.p.m. based on total overhead input. The larger concentration reduced corrosion to one-third that of the smaller one, reported Bennett. At a cost of only 0.3 mil per barrel of charge, the damage rate was reduced to an acceptable figure.

Where it was used . . . Steam reboilers were protected by injection of water soluble polar inhibitors directly into the steam line. Bennett explained that maintenance on these vertical reboilers had been very costly because of internal corrosion on the lower portion of the tubes. Usually the corrosion product would completely bridge across the tubes. The inhibitor program for these reboilers was started 11 months ago and the last inspection proved the tubes to be in very good shape. In this case, according to Bennett, the detergent action of the inhibitor has played a very important part.

Severe corrosion in a deisobutanizer, installed on the West Coast, has been completely checked by combined use of a 5 per cent solution of a high-molecular weight polar inhibitor and small amounts of sodium hydroxide, said Bennett. This combination is injected into the tower overhead stream and has reduced the iron content of effluent water to 0.42 p.p.m. Bennett stressed the importance in this case of the use of a caustic to control the stream pH. Use of the inhibitor alone materially reduced the iron count but the addition of caustic brought another significant decrease. Bennett also stated that had this program not been successful the operator would have been forced to use a critical alloy metal to solve the problem.

Maintenance charges on large vacuum pumps have been cut to one-fifth their former figure in one case, Bennett said, again emphasizing the detergent value of polar compounds. This was accomplished by adding inhibitors to the oil supply of the pumps. Valves and rings which formerly required repair or replacement every 2 to 3

months are still operating satisfactorily after more than 9 months' service.

Measurements of results . . . The use of test coupons is the most trustworthy method of determining corrosion rate, Bennett reported. He said that measurement of iron content should be used to determine the optimum amount of inhibitor as well as the best value of stream pH but should not be relied on for quantitative measurements.

Hydrolysis Gets Blame

Sulfate scale hydrolysis causing corrosion of tubing in sweet oil wells producing little water, N.A.C.E. is told

KANSAS CITY. — Water-independent corrosion of sweet oil wells is now thought to be caused in some instances by hydrolysis of sulfate scales laid down on tubing walls, H. E. Greenwell, Atlantic Refining Co., said here last week delivering a subcommittee report to the TP-1 committee of the National Association of Corrosion Engineers.

This conclusion, Greenwell said, resulted from inspection of tubing from numerous wells producing very low water quantities and still suffering tubing corrosis failure. The failures were characterized by sharp pitting with the entire tubing string coated with a red scale. Analysis of this scale showed that it was principally of barium and calcium sulfates. One committee member reported scale of 90.4 per cent barium sulfate with the remainder primarily calcium and chloride compounds.

To add evidence to the conclusion, Greenwell reported the corrosive action had been duplicated in laboratory tests. In these tests specimens with sulfate scales were placed in a nitrogen atmosphere wherein free oxygen was completely excluded. Bright-surfaced specimens used for control in the test showed no sign of corrosion but the scaled coupons exhibited corrosion damage similar in all appearances to that of wells in field tests.

Corrosion criteria . . . In cases involving water-dependent corrosion, the measurements of the iron content of produced waters cannot be regarded as an accurate basis for judging corrosion rate, Greenwell said. This is because natural formation waters often have an iron content that is quite high, with the magnitude varying from well to well throughout a field. It was thought by the committee that there is neither a safe nor critical level of iron content—the only sure sign of corrosion elimination is the complete absence or reduction to a very low value of the iron in produced water.

For this reason an operator must be very careful in his evaluation of an inhibitor performance as a basis of iron content. Other methods, such as caliper surveys, should be used in conjunction with well water analysis.

High temperatures affect amines, Greenwell said, and some are known to lose their efficiency at temperatures in the order of 200° F. This is a temporary impairment only with the inhibitor being reactivated as soon as zones of lower temperatures are reached.

New tool helps . . . Trouble in getting inhibitors on bottom was reported by several members and Greenwell mentioned a newly developed tool which may offer a solution to this problem. Liquid inhibitor is placed in the device and lowered into the well. A thermostatically controlled valve, set to operate at bottom-hole temperature, releases the liquid when the assembly is on bottom. Bypass valves, having been open to allow the tool's descent through the well fluid, are closed automatically when the container reaches bottom. The tool is forced back to the surface when the well is next opened for production. A special well-head lubricator is used for injecting and retrieving the device.

Stick-type inhibitors . . . Use of stick-type organic inhibitors is still predominate for treatment of condensate wells, R. C. Buchan, Humble Oil & Refining Co., said. Most operators, he reported, are tending to lower the frequency of treatment on individual wells but are still using about the same amount of chemical per volume of gas produced.

Protections of multiple-completed **wells** involves the same techniques as in protecting single wells, Buchan said. He told the committee that low iron content of produced water, while not a quantitative measure of corrosion rate, is the best indication of a successful inhibition program. Because of greater risks involved with dual wells, he suggested to members that they should strive for an even lower iron content in water from dually completed wells than in that from single wells.

Cathodic protection of well casing to depths of 6,000 ft. is definitely possible, Jack Barrett, Stanolind Oil & Gas Co., told the committee. High driving potential and considerable current would be required, however, and it might take several months for potentials to build up at the lower levels.

North Dakota Map Finished by Magnolia

Every oil well and lease in the North Dakota portion of the Williston basin is plotted on this huge 12 by 74-ft. map of the state prepared for Socony-Vacuum Oil Co. by its southwestern affiliate, Magnolia Petroleum Co. at Dallas. Scaled at 2 in. to a mile, the map is being pasted down by Hugh Pryor, left; Medford Webb, center; and Wesley Sanders. In addition to North Dakota, Magnolia has mapped Oklahoma, New Mexico, Texas, Kansas, and Louisiana and part of Alabama, Arkansas, Illinois, Indiana, Mississippi, and Nebraska.

U. S. Tanker Fleet at Low Point

● MSTS study shows we have fewer ships than in 1945, far less tonnage than needed for war.

● Navy wants to tackle the problem by offering 10-year charters for new, fast ships to encourage construction

Bertram F. Linz

WASHINGTON. — The American flag tanker fleet today is a third smaller than it was in 1945 and is more than 1,250,000 tons short of wartime requirements.

This, and the advancing age of American tankers—averaging 9½ years or close to half the accepted 20-year life—has prompted the Navy Department to ask Congress for authority to enter into 10-year charters of twenty 25,000 deadweight ton vessels with a minimum speed of 18 knots fully loaded. They would be built in American shipyards in the next 2 to 4 years.

The vessels would replace 37 of the 53 World War II T-2 tankers now being operated by the Military Sea Transportation Service.

The replaced vessels could be used for supplemental oil transportation, if needed, or placed in the National Defense Reserve Fleet. At the present time there are a dozen tankers in the reserve, but eight of them are minor types, two are Liberty vessels converted to distillate ships and the remaining two, built early in the war, are badly damaged and not capable for speeds in excess of 12 knots.

The plan proposed by the Navy would cost the Government nothing for construction and no more for chartering than is now paid for hauling an equivalent volume of oil. It would, moreover, narrow by approximately 500,000 tons the estimated deficiency in meeting requirements at the outbreak of a war.

The situation has been outlined in a tanker study by the MSTS.

Tonnage rise and fall . . . The world tanker fleet, between 1939 and 1953, grew in deadweight tonnage from approximately 17,000,000 to approximately 31,000,000 tons. The U. S. fleet, between 1939 and 1945, increased from about 4,100,000 to 12,100,000 tons. Since 1945 it has declined to approximately 7,800,000 tons due primarily to Maritime Administration on sales for operation under foreign flags, transfers of ships by American citizens to foreign flags, scrapping and maritime losses.

The U.S. fleet also is at a disadvantage from the standpoint of age when compared to the fleets of other countries, the MSTS found. Only 5 per cent of the fleet is of postwar construction, 83 per cent of the vessels being warbuilt and 12 per cent of prewar construction.

As of last June 30 the United States had effective control over 632 privately owned tankers of 1,000 gross tons and over. Of this total 456 were under U.S. registry and 164 registered foreign. In addition to these vessels, the MSTS operates 69 tankers of various sizes.

Less than 5 per cent of the tanker tonnage under construction is for the U.S. fleet, MSTS said. The rate of new construction for foreign registry poses a serious problem "for it means that new, modern, fast and efficient foreign flag ships will offer still greater competition in a market in which American operators, with few exceptions, have generally been at a disadvantage."

U.S. now short . . . With full recognition of the fact that the requirements for the U. S. tanker fleet are subject to review and modification in the light of changing strategic situations, the Defense Department has determined the U. S. privately owned and MSTS tanker fleets should consist of a minimum of 9,916,500 deadweight tons. This minimum required tonnage for the U.S. tanker fleet indicates a current deficiency of 1,471,400 tons, the equivalent of 89 T-2 tankers.

Requirement to stay high . . . Because of existing world tensions, the future MSTS tanker requirements are difficult to estimate with any degree of certainty. U.S. military world-wide petroleum liftings during the 3 years prior to the Korean war averaged 38,757,000 bbl. of clean and 31,982,000 bbl. of black products a year. During the fiscal year 1953, the last of the Korean war, liftings were 89,196,000 bbl. of clean and 43,218,000 bbl. of black products, nearly 32,000,000 bbl. greater than pre-Korea liftings. In the same periods, the MSTS-USNS fleet of 43 T-2 equivalents carried 38,368,000 and 69,990,000 bbl.

As a result of the truce in Korea there has been some reduction in military POL shipping requirements to that area. From a world-wide standpoint, however, because of the expansion of fleet activities and overseas military installations since 1950, MSTS believes it unlikely that the over-all POL requirements will be reduced to the point of the 1948-50 averages.

The 20 vessels which the Navy seeks to have authorized, plus 4 Orion "supertankers" which it is getting under 5-year charters, are estimated to be able to lift approximately 42,000,000 bbl. per year, or about 60 per cent of the pre-Korea liftings.

Incentives . . . Since the new tankers would be chartered for 10 years, or approximately one-half their useful life, the ships would revert to the owners' use in routine commercial operations unless the charters were extended. This, it is felt, will have an influence upon the type of tankers to be constructed in that the ships must possess features adaptable to commercial use so that prospective bidders may attract the capital necessary for construction.

Of 51 tankers built in American yards in 1953 or now under construction, the MSTS survey showed, 35 are of 25,000 deadweight tons or more, but only 4 are designed for 18 knots and the balance have speeds ranging from 15 to 17.5 knots.

Other specifications include not more than 32 ft. maximum draft, 84 ft. maximum beam and 650 ft. length over-all. These would permit the proposed new ships to berth at the majority of loading and discharging ports required for military operations.

No new burden . . . The new ships would impose no additional burden on MSTS costs. The larger tanker, carrying almost twice the cargo of the T-2 vessels, can operate with a crew approximately the same size, and will consume only about one-third more fuel. As a result of its ability to deliver more cargo per call, port expenses will be reduced proportionately.

The Navy program will provide impetus to the domestic shipbuilding industry which has declined to a prewar level of activity. It will provide the opportunity for American shipyards to develop a larger and faster commercial-type tanker of modern design and at the same time hold intact an important segment of the nation's shipbuilding capability. Finally, a revival of shipbuilding would assist materially in maintaining the level of steel production and employment in related industries essential to the economy of the nation and the national defense potential.

Smackover Test

Wildcat in area previously nonproductive has showing

MONROE, La.—Further incentive for Smackover exploration in the Eastern Gulf province is given by promising oil showings at a remote wildcat being drilled by the California Co. in East Carroll Parish, northeastern Louisiana.

The 1 Greeson recovered a showing of approximately 20°-gravity oil in the Smackover topped at 7,228 ft. Few details are being released by the company. Casing has been run to the top of the Smackover and hole is being cleaned out to total depth of 7,268 ft. It is understood that open hole will either be acidized or fractured during testing operations.

The wildcat lies in a practically nonproductive area of the Mississippi embayment just across the Mississippi River from Issaquena County, Mississippi. Nearest Smackover production is in southern Arkansas fields, about 100 miles northwest.

An increased Smackover search has been evident in the past few months throughout the east gulf province. Carter Oil Co. has a Smackover discovery in Madison County, Mississippi. The gas-condensate strike is having completion difficulties due to noninflammable and poisonous gases.

Merger Vote Planned

HOUSTON. — Properties of Texas Northern Oil Corp. and Gulf Coast Leaseholds, Inc., will be consolidated if such a plan is approved by stockholders later this month.

Under the plan, Gulf Coast Leaseholds will buy assets of Texas Northern through an exchange of stock. Assets consist principally of a substantial interest in newly discovered North League City field, in Galveston County. If approved, the plan would give Gulf Coast Leaseholds about a 50 per cent interest in the discovery well and 44 per cent interest in the entire 2,000-acre drilling block.

Bay Junop Strike

First oil production found on long-explored salt dome

HOUMA, La.—First oil production at Bay Junop, long-explored salt dome 35 miles southwest of here in the coastal marsh area of southern Terrebonne Parish, was opened the past week.

The discovery well, drilled by The Texas Co. with Union Oil Co. of California as joint owner, flowed at the rate of 308 bbl. of 27.9°-gravity oil per day through 9/64-in. choke with 2,000 psi. pressure and a gas-oil ratio of 249 cu. ft. per barrel.

Production is from Miocene sand with pay interval at 12,817-23 ft. Hole was drilled to 13,689 ft.

Well designation is 3-5 Bay Junop Unit, on State Lease 725, in 22-21s-13e.

Location is a mile off the west side of the dome and approximately 5 miles southwest around the dome from three deep gas and condensate wells, the only other production on this structure.

These wells, drilled by the same operators, have been completed within the past year, the first last June.

Discovery of the gas and condensate production climaxed 24 years of exploration and the drilling of 29 tests on and around the dome.

Calco Takes to Air

Aerial tramway is planned to Bay Marchand platforms

NEW ORLEANS.—An aerial tramway to transport men and equipment to drilling and production platforms at Bay Marchand in the Gulf of Mexico will be built by The California Co.

Company officials said last week the tramway is only in the planning stage and details of its design are not available. The company has made formal application, however, for permission of U. S. Army Engineers here to build the tramway.

According to the Engineers, the device will be approximately 8,140 ft. long and will be located 22 miles south of Leeville in Lafourche Parish. The tramway track will be supported by towers 1,630 ft. apart spaced between shore and the Bay Marchand field, where Calco is currently running two rigs from a drilling platform. Calco also has several production platforms in the field.

The tramway would enable the company to cut transportation costs now involved in the use of chartered boats, in addition to solving the navigation problems involved. In spite of the fact drilling and production platforms are 3 miles or more from shore they are shallow-water locations and small boats are forced to travel dredged channels or run aground on mud banks. The problem is accentuated at night because the dredged boat channels are not usually marked with warning lights.

Deep Gulf Producer

Stanolind wildcat breaks depth record, opens field

BAY CITY, Tex.—A new producing depth record for the Texas Gulf Coast was set, and a new field opened last week when Stanolind Oil & Gas Co. completed a 13,000-ft. gas-condensate well at its 1 Sanborn, a wildcat, 10 miles southeast of here, in eastern Matagorda County.

Productive interval of the well, in Frio sand, is 13,048-68 ft., from which flow was estimated at 13,500,000 cu. ft. of gas daily with a gas-condensate ratio of 50,000 cu. ft. of gas per barrel.

Previous deepest production on the Texas coast was in Chocolate Bayou field, in adjoining Brazoria County, where Phillips Petroleum Co. has a well, 1-A Houston Farms R, completed in 1952, flowing gas-condensate from Frio sand at 12,847 ft.

The new well not only sets a new

producing depth record for the Texas Gulf Coast but also for the entire state, outside of West Texas. In West Texas, production is obtained at various greater depths in many areas; in one field, Glenna, in Pecos County, production is below 15,000 ft.

Stanolind's deep producer was drilled to 16,120 ft., but this drilling depth has been exceeded a number of times, not only on the Texas coast but in other parts of the state.

Multiple-Pay Well

Texas battleground marks location of new oil play

HOUSTON.—San Jacinto Battleground, 15 miles east of here, where early-day Texans won their independence from Mexican rule, is the scene of a live oil play.

Almost in the shadow of the lofty monument commemorating Gen. Sam Houston's victory over Mexico's Santa Anna, an indicated multiple-sand oil and gas discovery well is due to be completed soon.

Before the discovery well's completion, drilling has been started on three additional wells in the immediate area.

The discovery well, 1 Trichelle, located 1½ miles south of the monument, was drilled by Olympia Oil & Gas Co., Ltd. Hole has been carried to a total depth of 7,652 ft., logging, it is reported, 73 separate showings. Although full details have not been revealed, two drill-stem tests in a sand section from 4,114 to 4,145 ft. got appreciable gas and made substantial recoveries of oil or distillate-cut mud. Oil-saturated sand was recovered in 11 cores from 7,552 to 7,652 ft.

Additional wells starting, all by the same company, include 1 Thayer, 1,320 ft. northwest of the discovery well; 1 Andrews, the same distance southwest; and 1 Hine, 3,100 ft. south.

The wells are on a block of 1,700 acres leased in 1953 for Olympia by Merrill I. Richardson, son of the late Joyce Richardson, for whom Joyce Richardson field, west of Fairbanks, was named. Leasing and drilling have been based on seismic surveys made for Olympia by Marine Exploration Co., of Houston.

Attention was called to the area when N. B. Hunt and Olympia completed a 44,000,000-cu. ft. gas well about 2 miles west and a little north of the present activity, in August 1952. That discovery, with pay sand at 5,452-62 ft., was designated as Lynchburg field. No other wells have been drilled in the area until now.

NATIONAL AFFAIRS

Final Tidelands Word

Congress' right to dispose of tidelands upheld by court as it denies Alabama and Rhode Island right to sue U. S.

WASHINGTON. — The Supreme Court last week wrote what may be the final word in the long controversy over the tidelands.

In a brief opinion, the court denied Alabama and Rhode Island the right to test the validity of the submerged lands act and affirmed the right of Congress to dispose of the lands. The court previously ruled the federal Government has paramount rights in the lands.

"The power of Congress to dispose of any kind of property belonging to the United States 'is vested in Congress without limit,'" the court held, citing previous opinions.

A similar suit filed by Arkansas last year in the federal court of the District of Columbia will probably be dropped in view of the action of the court.

The court's opinion, consisting largely of citations from previous cases, declared Congress not only has the legislative power over the public domain but also exercises the powers of the proprietor.

"Congress may deal with such lands precisely as a private individual may deal with his farming property. It may sell or withhold them from sale. It is not for the courts to say how that trust shall be administered. That is for Congress to determine."

The court voted six to two against permitting the states to sue, with Chief Justice Earl Warren of California not participating. Justices William O. Douglas, who wrote the opinions holding the Government had paramount rights in the tidelands oil resources, and Hugo L. Black wrote separate dissents, and Justice Stanley F. Reed wrote a separate concurring opinion.

Background of dispute . . . If no further effort is made to contest the law, a controversy of nearly 20 years' standing will finally be ended.

The issue of offshore ownership was first raised in the early 1930's by applicants for federal leases on California tidelands already leased by the state. The late Secretary of the Interior Harold L. Ickes held the lands to be state-owned but later changed his mind and asked the Department of Justice to test title.

Eventually the Department of Justice filed a suit against California in the Supreme Court and later filed suits against Texas and Louisiana, succeeding in getting decisions in all three that the federal Government had "paramount" rights in the oil and other resources of the submerged lands.

Following those decisions, exploration and development in the marginal seas was suspended while efforts were made in Congress to enact legislation overriding the court decisions. With the change in administration last year, those efforts were successful and Congress enacted two laws, the first restoring the historic boundaries of the coastal states and the second setting up the machinery for federal leases in the Continental Shelf beyond the state boundaries.

Dealer Complaints Studied

WASHINGTON.—Dealer complaints of marketing practices of major oil companies on the West Coast are under study by the Senate small business committee and may be made the subject of a general investigation.

Basis for the investigation are charges that during 1952 independent jobbers in the area had their products quotas cut by as much as two-thirds on representations of an alleged shortage of products due to increased military demand. At the same time, they charge, the major companies were picking up new dealer accounts and allegedly supplying them with the products which were not available to the jobbers.

The committee held public hearings in Seattle last November to make complaints a matter of public record. At the same time complaints against company practices were received from service station lessees of major companies about arbitrary stipulation of hours of operation, control of resale prices and enforced purchase of accessory items from certain sources of supply which gave the companies a commission on the sale of the item.

These complaints are now being studied and a decision will be made shortly concerning possible future hearings at which the major companies may be invited to answer.

Oil Studies Slated

NPC may be asked to study Gulf-East Coast pipe line

WASHINGTON.—Three and possibly more studies of oil industry problems are expected to be requested by the Interior Department at the initial 1954 meeting of the National Petroleum Council this week.

The council may be asked to study ways and means of providing an additional 1,000,000 bbl. daily of overland oil transportation from the major producing areas to the East Coast. This is a problem with which the Petroleum Administration for Defense has been wrestling for many months with little indication that the oil or gas industries are willing to build the necessary pipe line capacity at their own expense.

The department already has asked the council to bring up to date earlier studies on storage capacity and radio and radar requirements of the industry.

A report on storage capacity was made by the council last year, but the department is asking that it be brought up to date as of March 31, 1954. The new report is to be in three sections, types of storage, types of products stored and volume of products stored.

The council has no studies hanging over from last year on which to report, and its meeting March 23 will be largely devoted to organizational matters, the election of officers and the agenda and appointments committees and discussions of oil matters by government officials.

Both Interior Secretary Douglas McKay and Assistant Secretary Felix Wormser are expected to attend and talk about the transition from the Petroleum Administration for Defense to the Oil and Gas Division of the Interior Department. Defense and State Department officials also may brief the council members on current military and international developments.

Regulation Bill Approved

WASHINGTON.—Legislation removing natural-gas distributing companies operating in a single state from the jurisdiction of the Federal Power Commission has been sent to the White House for approval.

The bill overrides the 1950 decision of the Supreme Court in the East Ohio Gas Co. case. It was passed by the House last year but did not reach the Senate in time for action before adjournment.

The bill is designed to eliminate duplication of regulation of natural-gas distributing companies and restore to state public utility commissions full control which they exercised over such companies up to 1950.

Aviation Needs Revealed

WASHINGTON.—The military will need 20,000,000 bbl. of aviation gasoline during the last half of this year and more than 39,000,000 bbl. of jet fuel in the 9-month period from July 1 to March 31, 1955.

The Armed Service Petroleum Purchasing Agency revealed the military requirements in invitations for bids now going out to suppliers. They call for 11,953,000 bbl. of Grade 115/145 avgas; 6,290,100 bbl. of Grade 100/130; 1,599,500 bbl. of Grade 91/96, and 116,300 bbl. of Grade 80.

Jet fuels will be purchased by advertised bids for the first time. In advertising for a 9-month supply, ASPPA hopes to be able to redistribute the aviation fuels work load which normally comes in June-July and December-January.

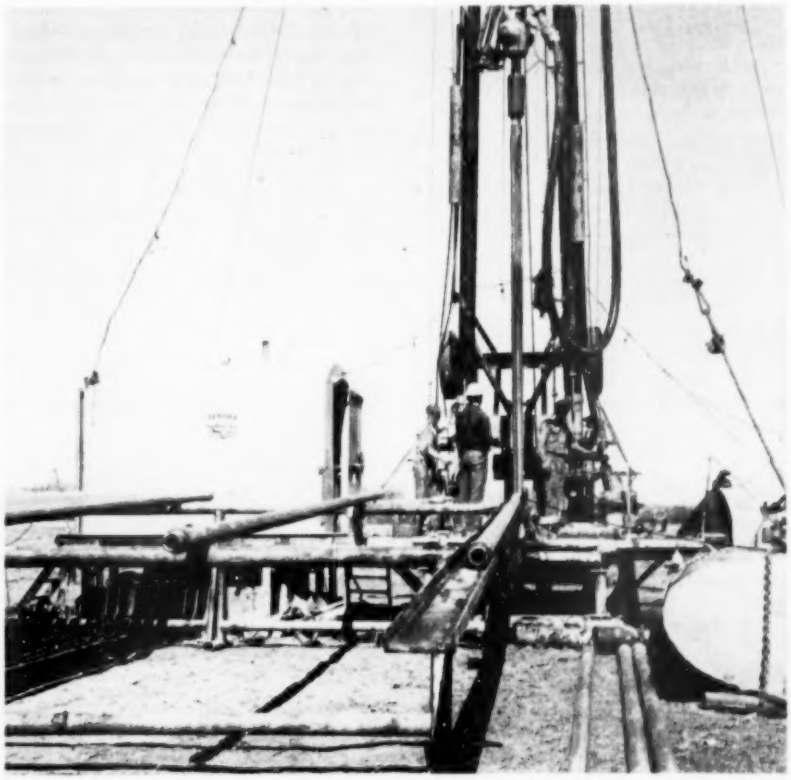
Expansion Record Predicted

WASHINGTON.—The oil industry is expected to spend more money on new plants and equipment during 1954 than ever before—in spite of the current economic shakedown.

The 1954 expansion of petroleum facilities will amount to $2,860,000,000, an increase of 4 per cent over that spent last year, according to a survey made by the Securities and Exchange Commission and the Department of Commerce.

The figure does not represent all capital requirements, since lease acquisition, exploration costs, and similar expenses are not considered plant and equipment.

The oil industry's expansion plans are in sharp contrast with those of business in general. The survey showed planned investment by businessmen in new industrial service and trade facilities will run $27,200,000,000 or 4 per cent less than last year.



This Mast Rolls on Own Wheels

This mast of the Texoma Drilling Co., of Wichita Falls and Archer City, Tex., is not trailer-mounted—it IS a trailer. The wheels and tires are mounted permanently in place on the mast. For rigging-down, the top section telescopes into the lower, the mast is lowered onto the wheels, and a trailer hitch at the crown block is used for towing. Draw works and drilling engine are skid mounted, as are the slush pump and engine. The rig is drilling the J. B. Walling 1 Ellis in Okfuskee County, Oklahoma, and has only recently completed an offset at 2,900 ft. Two roughnecks and the driller comprise the crew, and the pipe is laid down in singles during round trips.

New Fracturing Idea

Use of viscous treating mixture causes vertical fractures, promises higher output, Continental engineers tell A.P.I.

Kenneth B. Barnes and Edwin McGhee

OKLAHOMA CITY.—A new method for inducing vertical instead of horizontal fractures in producing formations promises to give increased production where vertical permeability is low.

The method, developed and tested by Continental Oil Co., was outlined here last week before the Mid-Continent district meeting of the American Petroleum Institute's Division of Production by Roscoe C. Clark and J. J. Reynolds.

The authors described Continental's laboratory work, which shows, they said, that when nonviscous fluid is used to break down formations, fractures usually will occur horizontally along a bedding plane.

According to Clark and Reynolds, horizontal fractures are limited in their ability to increase oil and gas production, and are ineffective in formations which have normal horizontal permeability and little or no vertical permeability. In addition, horizontal fractures are not considered good practice where water flooding or other secondary-recovery operations are anticipated.

How it works . . . The method developed by Continental uses a viscous fracturing media, such as oil-base mud containing ground walnut shells, and is intended for open-hole completions.

Except for the use of a viscous media, the technique for inducing a vertical fracture is essentially the same as for inducing a horizontal one. A viscous fluid cannot penetrate the formation and is, thus, wholly contained by the walls of the hole. When pressure is applied, the weakness of the formation face proves to be vertical; therefore, the fracture can be expected to be vertical, the Continental men said.

On the other hand, a nonviscous media will penetrate the formation and is only partially contained by the walls of the hole. Applied pressure is transmitted into the bedding planes of the formation along which the fluid has penetrated. The bedding planes thus become the points of weakness, and it is along them that the fracture is most likely to occur.

Field tests have established the effectiveness of the vertical fracturing methods, Clark and Reynolds said. There is every indication that vertical fracturing will be an effective aid to secondary—as well as to primary—recovery operations.

(A complete report of Continental's vertical fracturing treatments will appear in an early issue of the Journal).

Permanent completions tried . . . The permanent-type completion which was developed and is now used extensively on the Gulf Coast, is being tried on an increasing scale in the Mid-Continent area.

Reporting to the A.P.I. group, C. B. Strauch, G. W. Atchley, and E. R. Daniel, of Republic Natural Gas Co., cited several instances of the use of permanent-type completion equipment, particularly the tubing-type perforating gun, in Mid-Continent wells. A saving was reported, both with the tubing-type perforator and with wire-line retrievable gas-lift valves.

Fracturing improvement . . . A new method of blending and proportioning sand and oil should prevent many of the "screenouts" that have occurred during fracturing treatments in the past.

W. E. Hasselbroek, A. Stegelman, and S. S. S. Westbrook, all of Halliburton Oil Well Cementing Co. and authors of a paper presented at the Oklahoma City meeting, said that the "blender" will allow the operator to vary the proportion of sand from a low initial concentration to a higher concentration after the fracture has been made.

The paper also reported that the new multiple fracturing techniques are resulting in higher initial production and that, in many cases, the production gains are more prolonged.

They pointed out that the trend in the Mid-Continent is toward the use of more fluid and more sand in each operation and toward a greater sand-to-oil ratio in the fracturing fixture (see drawing).

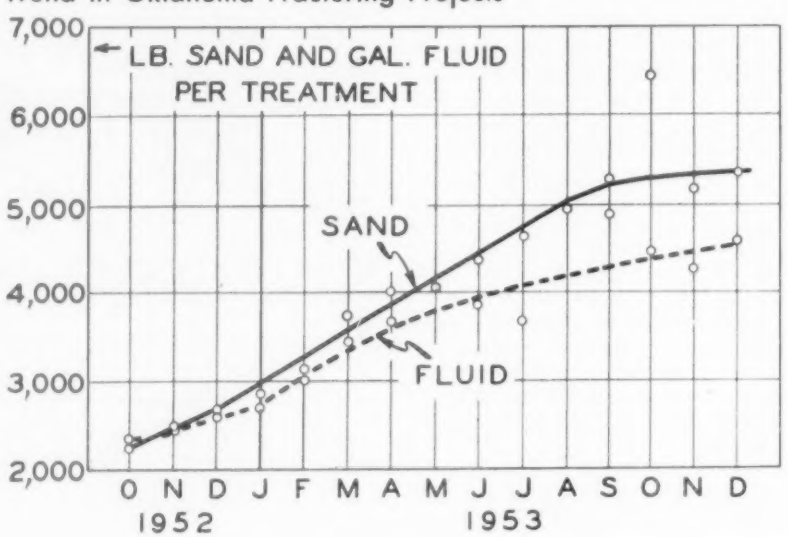
Casing savings possible . . . By successively reducing the design factors for tension and collapse, Shell Oil Co. has been able to affect a saving in pipe cost without inducing failure of the casing string, the meeting was told.

J. E. Saye and T. W. G. Richardson, of Shell's Tulsa office, reported that, following extensive tests in the Elk City, Okla., field, Shell has reduced its collapse design factor for cemented casing from usual 1.00 to a new low of 0.85.

In like manner, the factor for tension is now reduced from 1.60 to a value of 1.40. The authors reported that it was not found possible to reduce the design factor for collapse of uncemented casing below the conventional 1.00 value.

Principal advantage of the reduced design factors is in the saving from use of lighter grades of pipe. The new design factors will also greatly facilitate the design of casing strings for deep wells.

Trend in Oklahoma Fracturing Projects



Texas Ready to Tax

Substitutes for gathering tax are being considered

AUSTIN.—Hearings on new revenue measures to replace Texas' defunct natural-gas "gathering" tax are expected to be held by the state legislature this week.

The next move is up to the legislature since the Supreme Court last week refused to reconsider its decision striking down the levy which raised $14,000,000.

Several bills to replace the $14,000,000 and collect enough more to insure pay raises for Texas teachers were introduced last week.

Speedy legislative action is expected since House tax committee members voted to suspend rules requiring all bills to go to subcommittees for a week's study.

The revenue bills include:

... **The Shivers bill,** introduced by Rep. Joe Kilgore of McAllen. It contains provisions for a new gas gathering tax of 0.5 cent per M.c.f. to bring in $14,000,000 annually, a hike of 63 cents a barrel in the beer tax to bring in $3,000,000 and an increase in corporation franchise taxes of 75 cents on each $1,000 of assets to bring in another $8,600,000 a year. Total revenue proposed by the bill is $25,600,000.

... **The Patten bill,** introduced by Rep. Robert Patten, Jasper, which would impose a flat 1 cent per M.c.f. levy on natural-gas production. This would triple the present $23,000,000 annually collected from gas producers with the present levy of 5.72 per cent of value at the well head.

... **The Hinson bill,** introduced by Rep. George Hinson, Mineola, would levy 1 cent per M.c.f. on gas produced under the so-called dedication contracts of gas reserves. Hinson estimated the measure would take in about $30,000,000 annually.

... **The Pool bill,** by Rep. Joe Pool, Dallas, would raise the tax on beer from the existing $1.37 a barrel to $10.

New gathering tax . . . Shivers' new gathering tax, he contends is one that will not be contested in the courts. Basically it merely moves the point at which the gas would be taxed from the outlet of the gasoline plant back to the well. The tax voided by the Supreme Court was levied at the gasoline plant.

Shivers said his proposal "has been approved by some of the best legal minds in the State of Texas. They think it is constitutional, and so do I."

New Mexico Wells Planned

RATON, N. M.—Continental Oil Co. has announced location for the first of a series of wildcats in New Mexico's nonproductive Raton basin.

The well, 1 St. Louis, Rocky Mountain & Pacific Co. about 12 miles west of Raton, will be a stratigraphic test to the Magdalena (Pennsylvanian) at about 7,000 ft.

A six-well drilling program with some of the wells slated to go to the Dakota, has been announced by the company which has completed an extensive core and geophysical program through a part of this area. Continental has a block of about 500,000 acres in the basin.

The Raton basin, which covers part of northern New Mexico and southern Colorado, has had little previous drilling activity. Only a small amount of shallow drilling has been done. Las Animas County, Colorado, has seen some drilling in recent months but with no success.

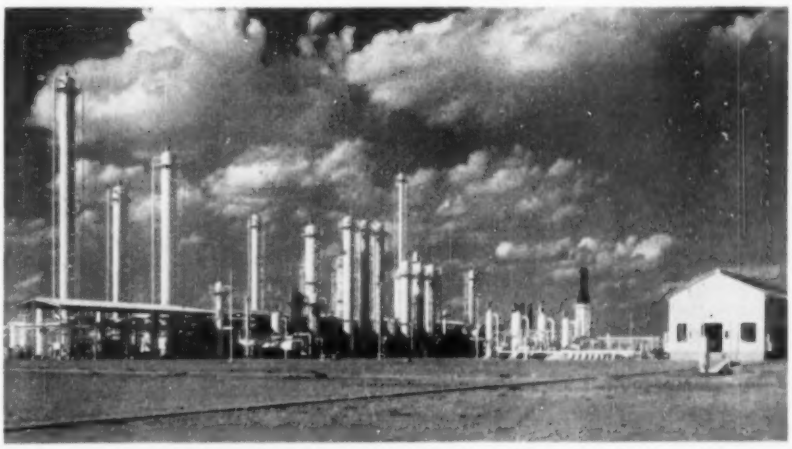
Land Trust Switch Seen

DALLAS. — Trustees of the huge Texas Pacific Land Trust are taking steps to convert the trust to a $150,000,000 oil company.

Headway was made by the trust last week when Judge Dallas Blankenship of the 101st District Court ruled that it should inform 75 per cent of certificate holders of the request and tentatively scheduled a hearing for June 1.

The trust was formed in 1888 by Texas & Pacific Railway to administer lands granted it by the state not actually used in building the railroad.

The trust now owns 1,797,156 acres in 29 Texas counties and holds mineral leases on 181,327 acres in 19 other counties. Present income is derived mostly from companies operating on its properties. If conversion of the trust to an operating oil company is approved, the mammoth organization would drill on other lands.



Plymouth Sells Interest in Benedum Plant

SINTON, Tex.—Plymouth Oil Co. has sold its half interest in the Benedum natural-gasoline plant in Benedum field, Upton County, West Texas, to Denton Oil Co., Lubbock, Tex.

The other half interest is held by Phillips Petroleum Co., Bartlesville, Okla. Plymouth, which built the plant, sold half interest to Phillips in late 1951.

W. L. Parker, chief engineer for Plymouth, said Denton Oil currently is operating the plant.

The Benedum plant, located about 13 miles northeast of Rankin, has a processing capacity of about 85,000,000 cu. ft. of gas daily and was built to extract natural gasoline, propane, normal butane, and isobutane. It also has facilities for producing its own absorption oil.

Prior to the sale, under contract arrangements between Plymouth and Phillips, the plant was producing only deethanized products, and its entire output was going into Phillips' products pipe line in the area.

Sale date was made effective January 1, 1954. Purchase price was not disclosed.

Abqaiq Injection Near

Aramco completing large pressure-maintenance plant to return 180,000,000 cu. ft. of gas daily to producing zone

THE Arabian American Oil Co. expects to place its large-scale gas pressure-maintenance program in operation in Abqaiq field in the next two or three months.

Facilities which have been under construction the last year and a half are now virtually finished. The operation involves the return of about 180,000,000 cu. ft. daily to the Arab zone below 6,000 ft.

Abqaiq field, where reserves have been unofficially estimated at six billion barrels, is now producing around 300,000 bbl. daily. It is planned to continue this producing rate under the controlled conditions made possible by the injection operation.

The Abqaiq project is the first large pressure-maintenance plant built expressly for this purpose in the Middle East. Bahrain Petroleum Co., Ltd., has been returning high-pressure, fourth-zone gas without compression to its second main oil pay for the last 16 years, and Anglo-Iranian Oil Co., Ltd., in Iran recycled products, mainly heavy fuel oil, back into Masjid-i-Sulaiman field via the gas dome, the totaled recycled amounting to some 100,000,000 bbl. in the 20 years preceding 1949.

Forerunner? . . . The Aramco plant may be a forerunner of others to come in the Middle East. Iraq Petroleum Co., Ltd., is reported to be studying pressure maintenance for Kirkuk field, and elsewhere the pressure decline in these Middle East huge reservoirs is being closely watched. In Saudi Arabia, pressure interference has been shown to exist between Abqaiq and sections of the huge Ghawar field 20 miles or more to the west and south.

While carrying out construction of the Abqaiq plant, Aramco has continued studies of the feasibility of a concurrent water flood. Abqaiq is an elongated anticline 32 miles long and averaging 6 miles in width. The gas injection will be on the south, crestal end where the oil column runs to some 1,500 ft.

Present investigations are considering a water flood into the northern part of the field where the formation has relatively little relief. Problems under study in this connection include source of water and exact location of the edge of the field. Even a pilot, or experimental flood is not likely before 1956, and it depends on further studies after the gas injection begins. It is felt, however, the water flood might further production of gas which would in turn be used to maintain maximum oil output.

Injection plan . . . Gas to be used in the program now about to begin will be taken from the high-pressure side of the three Abqaiq gas-oil separator plants. This gas will be compressed to approximately 3,000 psi. Centrifugal compressors will be used to raise pressure from 430 to 1,035 psi. in two stages, and reciprocating units will be used on the final high-pressure stage, *(The Oil and Gas Journal, December 27, 1951, page 40).*

Total cost of the pressure-maintenance project was about $20,000,000. This, however, includes some associated work such as the installation of electric motors and steam turbines for gas-expansion turbines formerly used on oil pumps at the three separator stations in the field. The compressor plant is located just east of the stabilization units in the main Abqaiq plant area. The injections wells are Nos. 6 and 50 situated near the main Abqaiq camp. A third well, No. 3, may be used later for injection if it is shown to be advisable.

Bolivian Venture Reported

Ray McLothlin, Austin, Tex., and Frank Marshall, Albuquerque, N. M., were in Lima, Peru, recently on their way to Bolivia to investigate possible exploratory operations in the latter country.

They were accompanied by Manuel Rodriguez Aguilar, former exploration department head of Petroleos Mexicanos in Mexico. A report from Lima said the two southwestern independent operators had plans to do wildcat drilling near Corumba and the Brazilian border.

Only foreign oil operator now active in Bolivia is Glenn McCarthy, Houston, who obtained a large concession in southeastern Bolivia last year. His organization was recently reported rigging up for the initial test on this acreage.

Tapline's Pump Stations Working Overtime

This self-contained community is one of five lying along the 1,068-mile, 30 and 31-in. Trans-Arabian pipe line from Saudi Arabia to the eastern Mediterranean. It is the Badanah pump station in northern Saudi Arabia, next to last on the route from Ghawar and Abqaiq fields to the Sidon terminal in Lebanon. Last year, Tapline moved 307,000 bbl. daily of 34.4°-gravity crude. Arabian American Oil Co. recently installed additional pumps at the Qatif junction on its section of the line, enabling more oil to be bled off to the Ras Tanura terminal and thus increasing capacity of Aramco's entire oil-handling system to slightly over 950,000 bbl. daily. The company's production recently has been pushing the maximum of its facilities (Aramco photo).

Israel Branching Out

Exploration drilling soon will probe more of country

EXPLORATORY drilling in Israel, up to now confined to the Dead Sea region, is expected to be extended soon to other parts of the country.

The first well undertaken in Israel on acreage granted under the 1952 petroleum law was started late last year as a joint venture of three companies, Jordan Exploration Co., Ltd., Lapidoth-Israel Petroleum Co., Ltd., and Israel Oil Prospectors, Ltd. These three Israeli companies are partly backed by foreign capital, principally from the United States.

Work is scheduled to start soon in Negev of southern Israel. Israel Continental Oil Co. is planning to drill in the Hadera area in the near future, and the Husky Oil Co. organization in the eastern Negev. Husky has about a half million acres under exploration permits, and has announced results of preliminary work were encouraging.

Seven granted licenses . . . These five companies—Jordon Exploration, Lapidoth-Israel, Israel Oil Prospectors, Israel Continental, and Husky—are among the seven which have been granted exploration or drilling license in the country under the 1952 law. The other two companies registered in Panama, are Pan Israel Oil Co. and Israel Oil Licenses, both headed by William F. Buckley, New York, who also is associated with Pancoastal and Pantepec oil companies. Pan-Israel has begun preliminary work on the coastal plain near Rehovoth.

Israel Oil Licenses has taken over acreage granted to G. H. Brodie, Denver. The licenses now held by Pan Israel were transferred to the company by Harrison, Newkirk & Abernathy, Toronto, Canada, the original concessionaire.

The well already under way is being drilled by the Kerr-McGee Oil Industries, Inc., as contractor.

Equipment Orders Drop

Completion of the major part of the refinery expansion in the United Kingdom resulted in a drop last year in the total of orders received by British firms for oil equipment and materials.

Figures compiled by the Oil Companies Materials Secretariat in London placed the 1953 total at £67,124,000, or about $188,000,000, compared to the record high total of £90,000,000, or $252,000,000 in 1952.

A substantial part of the orders last year were for use overseas, since Britain ranks next to the United States as the world's leading supplier of oil equipment worth approximately $22,400,000; tubulars, pipe fittings, and valves, $22,100,000; drums, drumsheets and tinplate, $15,300,000; tools and miscellaneous machinery, $14,800,000, and automotive equipment $14,000,000.

Referees to Decide Royalty

Texas Petroleum Co. (The Texas Co.) and the Colombian Government have agreed to appoint referees to decide the disputed value of the royalty which the company will pay on crude produced from Tetuan field in Tolima State.

Royalty accruing to the government in Colombia is by law determined on the distance at which the field is situated from the coast, the more distant inland fields carrying much lower royalty.

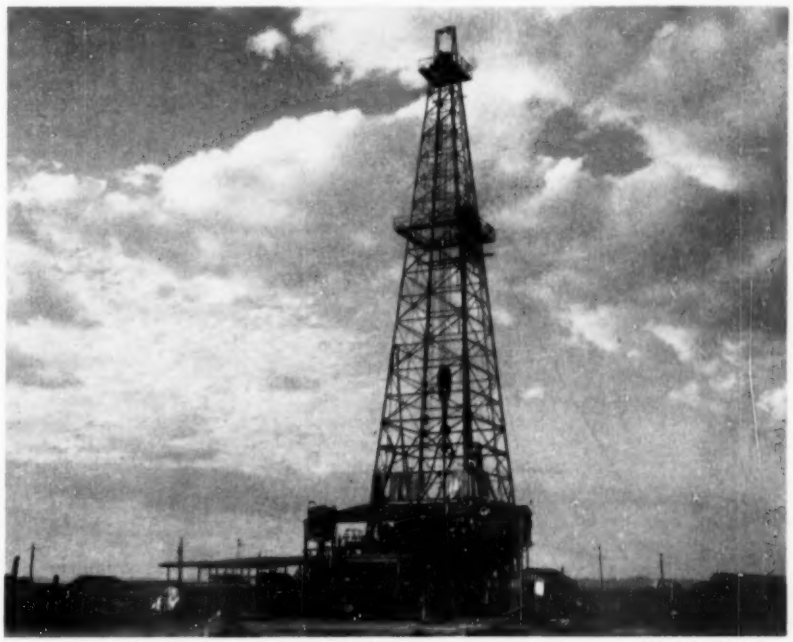
In the case of the Tetuan crude, the government contends the distance should be calculated by following the route on an imaginary pipe line west to Buenaventura on the Pacific Coast. This would make the royalty about 9 per cent. The company, on the other hand, considers the logical distance is the longer route via the Magdalena Valley to the Caribbean, making the royalty 3 per cent. The two existing crude lines in Colombia go north and west to Caribbean terminals.

Creole Figures Fluctuate

Operated production of Creole Petroleum Corp., leading Venezuelan producer, declined 43,497 bbl. daily in January to an average of 782,798 bbl. daily.

During the same month, total Venezuela production averaged 1,909,411 bbl. daily, down from the record high level of 1,935,152 bbl. daily in December.

Of Creole's production during January, 651,530 bbl. daily came from the Lake fields, 6,569 bbl. daily from elsewhere in western Venezuela, and 124,599 bbl. daily from eastern Venezuela. The company's net production plus purchased royalty oil amounted to 841,133 bbl. daily. Venezuelan Government reports for January show Creole's output as 840,984 bbl. daily, a figure based on concession properties held.



Second Iranian Company Working Quietly

Activities of a second Iranian Government oil organization, the Iran Oil Co., have escaped attention amid all the international furore created by the nationalization of the Anglo-Iranian Oil Co., Ltd., properties. Iran Oil Co., which was organized in 1949 to explore and develop oil in areas outside the Anglo-Iranian concession, is entirely separate from National Iranian Oil Co. which now operates Abadan and other nationalized A.I.O.C. facilities. For the last several years Iran Oil Co. has been drilling the Qum structure about 50 miles south of Teheran. Some production was obtained in the No. 3 well and the fourth test, Alborz 4, is nearing the productive horizon. Drilling is under contract to Drilling & Exploration Co. The program is designed to develop production near Teheran and the markets of northern Iran and thus obviate the expensive railroad haul of products from the Abadan area.

Magnolia Director

Cortes, former roughneck, now head of research

FROM a member of a rotary drilling crew to a member of Magnolia Petroleum Co.'s board of directors is the path that Henry C. Cortes has traveled during his 32 years in the petroleum industry.

In his latest position, to which he was elected recently, Cortes will be the executive in charge of Magnolia's research efforts. This is in addition to his duties as assistant manager of the company's exploration division, which consists of the geological, geophysical, and land departments.

Cortes, a native of Houston, attended the University of the South at Sewanee, Tenn. He first started in the oil business in February 1922 as a member of a rotary drilling crew in the Hull field of Liberty County, Texas.

Two years later, Cortes was employed by Vacuum Oil Co. in the geological department. While engaged in exploration work for Vacuum, he pioneered the fields of torsion balance and refraction seismograph work and interpretation throughout the Gulf Coast area.

In 1932, when Vacuum merged with Standard Oil Co. of New York to form Socony-Vacuum Oil Co., Inc., Cortes joined Magnolia, a southwestern affiliate. Five years later he was named director of geophysics, and on June 1, 1946, was made assistant manager of the exploration division.

Through geological and geophysical interpretations, Cortes has had a part in locating several oil and gas fields in the Gulf Coast area. Among these fields are Iowa, Cameron Meadows, West Gueyda in Louisiana, and Seeligson, La Gloria, and Tomball in Texas.

Cortes is a past president of the Society of Exploration Geophysicists, Dallas Geological Society, and the Petroleum Club of Dallas. He is a fellow of the Texas Academy of Science.

Cortes is also a member of the American Association of Petroleum Geologists, Petroleum Club of Houston, American Geophysical Union, American Association for the Advancement of Science, Seismological Society of America, Dallas Geophysical Society, and the Petroleum Engineers Club of Dallas.

S. C. Oliphant, Tennessee Production Co., Houston, has been elected chairman of the Southwest District of the American Petroleum Institute's Division of Production. **Charles Doh,** Schlumberger Well Surveying Corp., New Orleans, has been made secretary-treasurer and **Louis F. Davis,** Atlantic Refining Co., Dallas, has been named chairman of the district advisory committee.

W. B. Hopkins, Gulf Oil Corp., Houston, has been named chairman of the Gulf Coast Section of the American Institute of Mining and Metallurgical Engineers. Other officers and directors include: **James K. Jordan,** Humble Oil & Refining Co., vice chairman; **Herman A. Engel, Jr.,** Union Sulphur & Oil Corp., secretary-treasurer; and **R. C. Craze,** Humble, council of section delegates. Directors are **W. R. Purcell,** Shell Oil Co.; **R. M. Rutledge,** Lane-Wells Co.; **Roy A. Bobo,** Phillips Petroleum Co.; **H. M. Krause,** Humble; and **Kenneth B. Ford,** Butler, Miller & Lents. **Milton Cooke,** consulting engineer, is chairman of the membership committee.

M. Buford Penn, Mid-Continent Petroleum Corp., has been elected chairman of the Tulsa section of the American Institute of Mining and Metallurgical Engineers. Other new officers are **S. F. Bird,** Amerada Petroleum Corp., first vice chairman; **F. H. Callaway,** Stanolind Oil & Gas Co., second vice chairman; and Donald R. Johnson, Gulf Oil Corp., secretary - treasurer. New members of the executive committee are **R. A. Morse,** Stanolind; **M. J. Rzasa,** Cities Service Research & Development Co.; **Guy Williams,** Dowell Incorporated; **R. C. Clark, Jr.,** Continental Oil Co., Ponce City; and **A. T. Herman,** Cities Service Oil Co., Bartlesville.

M. M. McCallen, McCallen Refining Co., Ltd., has been elected president of the Independent Refiners Association of California. **D. D. O'Neil** has been re-elected executive vice president. Other new officers are: **N. D. Taylor,** Hancock Oil Co., vice president; **Malcolm McDuffie,** Mohawk Petroleum Co., secretary-treasurer and director; and **D. S. Fletcher,** Fletcher Oil Co., director.

Adam J. Rumoshosky has become director of the American Petroleum Institute's Division of Marketing, succeeding **Dr. John W. Frey,** who has retired. Rumoshosky first joined the A.P.I.'s Petroleum Industries Committee in 1937, and has been associate director of the Marketing Division since last July. Headquarters of the division have been moved from Washington to the A.P.I.'s main office in New York.

ROY L. LAY

Roy L. Lay has been appointed assistant to **E. R. Filley,** vice president in charge of the producing department of The Texas Co., with headquarters in New York. Since 1950 Lay has been manager of the firm's geophysical division of the producing department in Houston and has been replaced by **Otis B. Hocker,** formerly assistant manager.

Warren H. Kraft, of Honolulu Oil Corp., immediate past president of the California Natural Gasoline Association, has been appointed acting chairman during organization of the association's new chapter in the San Francisco Bay area. Working with Kraft as a steering committee are **L. R. Damskey,** Union Oil Co.; **Robert W. Edwards,** Republic Supply Co.; **E. E. Gialdini,** Standard Oil Co. of California; **S. A. Haavik,** Pacific Gas & Electric Co.; **L. L. Kissinger,** Tide Water Associated Oil Co.; **Harris Johnson,** Cooper-Bessemer Corp.; **F. H. Lacy, Jr.,** Honolulu Oil Corp.; **Donald Olstrom,** Standard of California; **Joseph R. Rensch,** Coast Counties Gas & Electric Co.; **Don Smith,** Tide Water Associated Oil Co.; and **Martin Smolak,** E. I. du Pont de Nemours & Co., Inc.

PERSONALS

A. S. RHEA

A. S. Rhea, formerly chief petroleum engineer and assistant superintendent of the operating department for Sun Oil Co.'s Southwest division, has been promoted to superintendent of the operating department, replacing **John A. Ritter,** who has retired. **F. G. Prutzman** was promoted from assistant chief petroleum engineer to division petroleum engineer to replace Rhea. Rhea joined Sun as a chemist in 1927, became chief petroleum engineer in 1947 and assistant general superintendent of production in 1948. Ritter had been with Sun for 31 years. He was active in the American Petroleum Institute since its inception and was presented a certificate of appreciation by the A.P.I. in 1950 for distinguished service and constructive leadership. Prutzman joined Sun in 1937.

J. A. RITTER

F. G. PRUTZMAN

Lt. Col. Marshall E. Myers has joined the engineering staff in Tulsa of Sinclair Oil & Gas Co. after resigning as executive officer of the Tulsa district office of the Corps of Engineers. He will work on Sinclair's unitization program and will be a staff engineer under **F. F. Wright,** assistant chief engineer. Myers, on active duty with the Army for 13 years, formerly was in the production department of Phillips Petroleum Co.

Joseph L. Seger, president of Interstate Oil Pipe Line Co., Shreveport, has been elected a vice president and director of Carter Oil Co., effective June 1. He will resign as president but remain a director of Interstate. **George A. Wilson,** former president of Interstate Natural Gas Co., Monroe, La., and more recently special assistant to the coordinator of transportation of Standard Oil Co. (N.J.), has been elected president of Interstate Oil Pipe Line, also effective June 1. The action was taken March 18 at directors meetings of both companies.

John L. Moye, petroleum engineer formerly with Magnolia Petroleum Co. at Shreveport, La., has joined Tennessee Production Co. at Houston.

Karl T. Feldman, chief engineer at Independence, Kans., for Sinclair Pipe Line Co., has returned after a temporary assignment in Venezuela.

Charles E. Pittman has resigned as district geologist in Enid, Okla., for Champlin Refining Co. to join Norbla Oil Co. as chief geologist in Tulsa.

George H. Roraback has been promoted by The Texas Co. from engineer trainee at Sourlake, Tex., to reservoir engineer at El Campo, Tex.

Ed Byrd has been promoted by Humble Oil & Refining Co. from assistant district superintendent at Conroe, Tex., to district superintendent at Thompsons, Tex.

Frederick G. Coqueron has been appointed to the official staff of Chase National Bank of New York as petroleum analyst. He joined Chase's petroleum department in 1936 and has developed statistical data relating to the oil industry, authoring such studies as "Financial Analysis of 30 Oil Companies," an annual survey.

W. M. Elmer, vice president and treasurer of Texas Gas Transmission Corp., has been named president of Texas Gas Exploration Corp., producing subsidiary formerly known as Louisiana Natural Gas Corp., now headquartered in Houston. **B. C. Adams, Jr.,** former gas supply vice president of Texas Gas, has been made vice president; **Fred Schall,** chief geologist; and **Duncan Foulds,** chief production engineer.

Stuart A. Levinson, Humble Oil & Refining Co., Houston, has been elected president of the newly organized Gulf Coast Section, Society of Economic Paleontologists and Mineralogists. **Grover E. Murray,** Louisiana State University, Baton Rouge, was elected vice president; **William H. Akers,** The California Co., New Orleans, was named secretary; and **Frank V. Stevenson,** Aluminum Co. of America's mining division, Houston, was elected treasurer.

Virgil D. Stone has been promoted by Gulf Refining Co. from area petroleum engineer at Buras, La., to drilling unit head on the zone engineer staff at Harvey, La.

Kyle K. Siehr has been appointed, effective April 1, purchasing agent of the Tulsa production division of Gulf Oil Corp., replacing **Victor C. Fuller,** who will retire on that date after holding the post since 1925.

E. G. Dobson, formerly chief petroleum engineer in the Venezuelan division of Texas Petroleum Co., has been promoted to chief engineer in the foreign producing department of The Texas Co., New York.

C. R. Walker has been elected president of Merrill Petroleums, Ltd., Calgary, Alta., replacing **N. E. Tanner,** who resigned recently to become president of Trans Canada Pipeline Co., Ltd. Tanner remains as a director and chairman of the Merrill board.

J. E. BOICE

John E. Boice, a veteran of more than 42 years in government service, has resigned as chief of the pipeline engineering and materials branch of the Petroleum Administration for Defense to become assistant secretary of the Committee for Pipe Line Companies. The committee is a voluntary organization representing more than 95 per cent of the nation's interstate petroleum pipe-line mileage. Boice, who was with the Interstate Commerce Commission for 30 years, served in the Petroleum Administration for War and in 1948 joined the staff of the Oil and Gas Division of the Interior Department, later transferring to PAD. Upon his retirement he was presented a citation for commendable service by **Joseph A. LaFortune,** deputy petroleum administrator.

Dan C. Morgan, Angleton, Tex., and **Doug Null,** Lake Jackson, Tex., have been promoted to new positions in Dow Chemical Co.'s engineering department at Freeport, Tex. Morgan, formerly clerical supervisor, has been named administrative assistant to the chief engineer; and Null has moved up to supervisor's post previously held by Morgan. **S. R. Pearson** has joined the com-

PERSONALS

pany as research and development engineer in the organic-research department.

Ezra W. Drake, formerly supervisory petroleum engineer at Maracaibo for Creole Petroleum Corp., has been appointed senior drilling administrator at Tia Juana. **Samuel J. Mathis,** formerly supervisory engineer at La Salina for Creole, has been named assistant district superintendent at La Salina.

DR. G. M. LEES

Dr. George M. Lees, retired chief geologist of Anglo-Iranian Oil Co., Ltd., London, has been chosen to receive the Sidney Powers Memorial Medal of the American Association of Petroleum Geologists at its thirty-ninth annual meeting in St. Louis April 13. **Charles C. Bates,** deputy director, division of oceanography, U. S. Navy Hydrographic Office, Washington, will be presented the A.A.P.G.'s President's Award. **John L. Rich,** professor of geology at the University of Cincinnati, and **George S. Hume,** chief of the Geological Survey of Canada, Toronto, Ont., have been elected to honorary membership in the A.A.P.G. The Sidney Powers Award, named in honor of the late Sidney Powers, Tulsa, fourteenth A.A.P.G. president, is presented in recognition of distinguished and outstanding contributions to, and achievements in, petroleum geology. It consists of a gold medal and scroll and is recognized as the highest professional and scientific honor in petroleum geology. The President's Award, consisting of a certificate and $100 in cash, is given to the author under 35 years of age whose article in the association's monthly Bulletin during the preceding year is judged to be "most significant original contribution to petroleum geology."

Dr. Gustav Egloff, director of research for Universal Oil Products Co., Des Plaines, Ill., has been selected to receive the 1954 Carl-Engler-Medaille, Germany's highest award in the field of petroleum science. The presentation to Egloff, the first scientist living outside of Germany to receive the award, will be during the annual congress of the German Institute of Petroleum and Coal during October in Essen, West Germany.

Marshall K. Shurnas, geologist with Magnolia Petroleum Co., has been transferred from Las Vegas, N. M., to Roswell, N. M.

J. O. Canfield has been promoted from geophysicist in the Venezuelan division of Texas Petroleum Co. to geophysical supervisor in the Colombian division.

E. L. Mount has been promoted from assistant to central regional geophysicist for Continental Oil Co., with headquarters in Oklahoma City. He has been with Continental for 26 years and held his former position 2 years.

Haden J. Upchurch has been elected vice president of Texas Eastern Production Corp. He will continue to manage the activities of the land department, headquartered in Houston.

H. W. Nippert, formerly district petroleum engineer in Midland, Tex., for The Texas Co., has joined Hanley Co. in Midland as assistant superintendent.

D. A. McGEE

Dean A. McGee has been elected president of Kerr-McGee Oil Industries, Inc., replacing **Sen. Robert S. Kerr,** who has been elected chairman of the board. **Travis M. Kerr,** formerly vice president in charge of drilling tools, succeeds McGee as executive vice president. **Frank C. Love,** counsel and formerly assistant to McGee, has been made vice president in charge of operations.

W. H. Tompkins, formerly production engineer at Liberal, Kans., for Panhandle Eastern Pipe Line Co., has been transferred to Kansas City as storage engineer.

E. W. Casagrande, formerly superintendent of Shell Chemical Corp.'s Shell Point plant, has taken over his new duties as manager of the company's plant at Martinez, Calif. **F. A. Horsley,** formerly assistant plant superintendent at Martinez, has succeeded Casagrande at Shell Point. **A. W. Fairbairn,** formerly with Shell Development Co. at the Emeryville, Calif., research center, will become assistant superintendent on April 1. He has been on special assignment at Amsterdam, Holland, but was scheduled to return this month. **B. O. Baldwin,** technologist with Shell Oil Co., has been transferred from the research department at the Martinez refinery to the New York offices.

Dan Turner has resigned as division geologist in Denver for William R. Whitaker Co., Ltd.

Robert F. Cory, petroleum engineer for The Texas Co., has been transferred from Santa Paula, Calif., to Los Angeles.

W. D. Miller has been appointed manager of the production department of Creole Petroleum Corp. in Caracas. **Dr. Siro Vasquez,** who has been both head of the department and a member of the Creole management board, will now devote all his time to the latter position. Miller, who has been assistant manager of the production department since July 1, 1953, worked 23 years with oil companies in the United States and Mexico before joining Creole as assistant engineer at La Salina.

DEATHS

Alexander T. Camden, 79, retired senior engineer for Socony-Vacuum Oil Co., Inc., died recently in Flushing, N. Y.

John Thies died recently in Hollywood, Calif. He had retired a few days earlier after 23 years with Signal Oil Co.'s purchasing department.

Frederic McCoy, 75, retired mechanical engineer and former president of Viking Oil Corp., Warren, Pa., died recently in Poughkeepsie, N. Y. His home was in Beacon, N. Y.

Albert J. (Al) Rosenlieb died recently in San Fernando, Calif. In 1948 he retired as division manager after 32 years with Ohio Oil Co.

Lester T. Burns, Sr., 60, independent producer, was killed in an automobile accident near Henrietta, Tex., March 17. His home was in Wichita Falls.

Oscar H. (O'Hara) Kilpatrick, 73, one of the geologists whose work led to discovery of Yates field in Pecos County, Texas, in 1929, died in San Angelo, Tex., March 12.

For 1954 Consider . . .

More From the Bottom of the Barrel

Seven modern fuel-oil-reduction processes . . .

The refining residual-fuel problem can best be met by reducing the bottom-of-the-barrel stocks, since supply and demand picture for the heavy fuels is such that selling price is much less than price of crude oil. Processes developed to solve this problem have been designed to convert portions of the residuals into suitable cat cracker feed stocks. Turn the page for detailed flow sheets and process descriptions of seven modern processes which accomplish this aim.

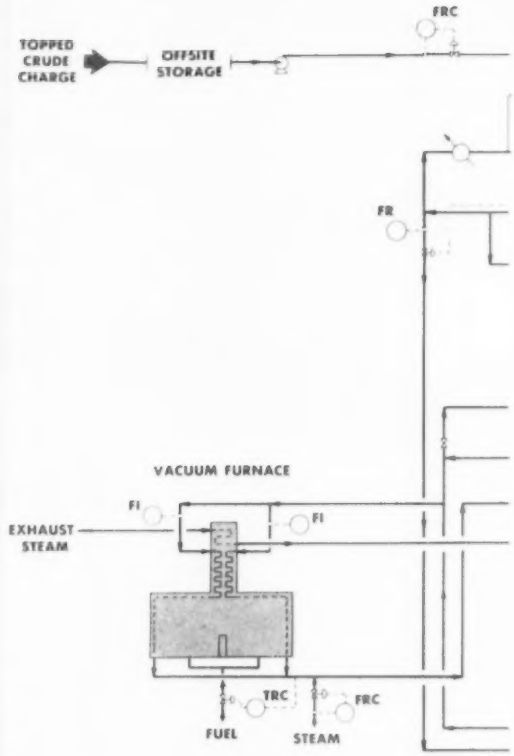
Discussions by authorities . . .

The most comprehensive discussion of the bottom-of-the-barrel problem yet compiled is presented here by The Journal's refining editor, George Weber, immediately following the process descriptions. His three-part discussion first takes up utilization of residuals, then petroleum-derived asphalt, and finally refinery coke. In addition to Weber's articles are six others, written by industry experts, dealing with cat cracker feed stocks, extraction of catalytic cycle stocks, coking, residual reduction, and refinery and other uses for burning residual fuels.

. . . and in addition

The Journal's 1954 Survey of North American Refineries, including operating plants in the United States, Mexico, and Canada; shutdown plants in these countries; and construction projects in the United States and Canada. Also, there are articles on other subjects of great interest to refiners. Among these are (1) What's New in Alkylation, (2) a complete article about the Model IV cat cracker of Pan-Am Southern at Destrehan, La., and (3) a resume of Suntide's Corpus Christi refinery operations.

VACUUM DISTILLATION



THE economic incentive for converting more of the residual crude fraction to light and middle distillates has promoted the increasing use of vacuum distillation of topped crude. This method is by far the most widely used to augment the yield of catalytic cracking feed stocks from topped crude. The overriding need for increasing catalytic cracking throughput will continue to promote expansion of vacuum distillation. As a result, many refiners are now adding vacuum distillation to existing atmospheric facilities, and most modern crude units incorporate the vacuum phase step.

In California, for example, the larger refineries maintain vacuum capacity as high as 40 per cent on crude, while some smaller plants will run as high as 60 per cent. In some inland refineries handling heavy crudes the percentage of vacuum equipment exceeds 60 per cent of crude capacity. East Coast and Gulf Coast refineries equipped with vacuum units vary in vacuum capacity, up to 45 per cent, depending on the types of crudes available to them.

Basic design varies . . . Numerous improvements in the design of vacuum units in the past few years have substantially increased their efficiency at a reduction in initial cost. The basic design of vacuum units varies with operational requirements.

For example, for a refinery with a long-range supply of pipe-line crude of unvarying characteristics, a closely integrated atmospheric and vacuum combination unit can be designed with a resulting high heat efficiency. On the other hand, when a refinery charges a number of crudes alternately and varies operations between long and short residua, it is considered more practical to recover heat from the atmospheric topped crude by exchange with other streams, and to operate a vacuum unit independently on a cold charge pumped from storage.

As a result there is no one type of vacuum unit which might be considered as typical. The accompanying flow sheet depicts a flexible design for processing various crude types. The degree of instrumentation and the selection of auxiliary facilities depend to some extent on the desires of the operating company.

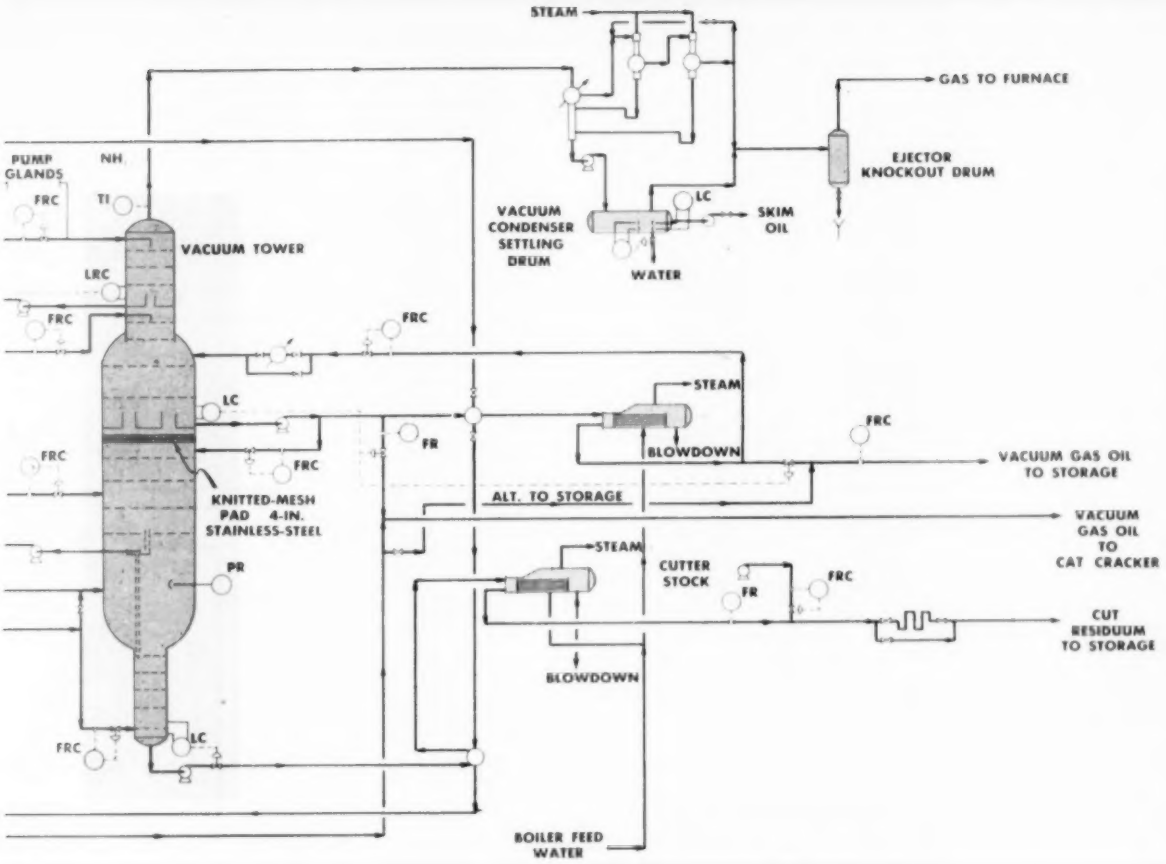
Improved furnace design has resulted in savings of as much as 25 per cent in initial cost. Smaller transfer lines designed for high stream velocity maintain higher pressures in the furnace proper and eliminate the need for expensive header arrangements and unusually large furnace tubes. The flash zone in the vacuum tower can be so designed that proper vapor separation is attained and entrainment is minimized.

More heat in tower . . . Another modification permits the introduction of more heat in the tower without the danger of overheating and cracking of the topped crude. A recycle of heavy distillate can be withdrawn from the tray above the flash zone and recirculated through the furnace to carry additional heat to the tower.

Many of the improvements in the efficiency of modern vacuum units stem from the proper design of the flash zone. Modifications in size, shape, diameter, and design of internals are the result of the know-how gained from years of design experience. The control of entrainment in vacuum operations looms important today, in view of the deeper cuts which are made in topped crude, and because of the great importance of minimizing the content of heavy asphalt and metal contaminants in heavy distillate stocks for catalytic cracking feed. A very small fraction of these undesirable constituents can affect catalyst life and the yield-product quality relationship in catalytic cracking to a marged degree.

Two design features have successfully solved the entrainment problem in modern vacuum units. They comprise the use of a fractionating section immediately above the flash zone, in combination with a knitted wire pad superimposed above the fractionating section.

Efficient latent-heat recovery . . . The bulk of the vacuum overhead vapors are condensed on the trays immediately above the pad and are collected by a total drawoff pan where the temperature of the withdrawn stream can run as high as 650° F. This permits efficient recovery of the latent heat at high temperature for charge preheat or steam generation. The distillate need not be cooled if used directly as catalytic cracking feed, but if sent to storage will be passed through the reflux system before final cooling.



The upper trays of the tower are employed mainly for cleanup to minimize overhead hydrocarbon losses. As the bulk of the vapors do not pass the condensing zone, these cleanup trays have a much lighter vapor load and may be much smaller in diameter than those in the main portion of the tower.

This cleanup section condenses practically all hydrocarbons, limiting the overhead vapor flow to inerts and steam only. This permits the use of a small low-temperature vapor line to the vacuum equipment.

Choice of equipment . . . The choice of vacuum equipment depends on the availability of cooling water and effluent contamination problems. Straight barometric condensers are now used only in isolated cases where no effluent disposal problem exists, and cooling water supply is plentiful. Tubular vacuum condensers permit recirculation of cooling water through the cooling tower, so that the only water to be disposed of is condensate from the process steam and the vacuum jets.

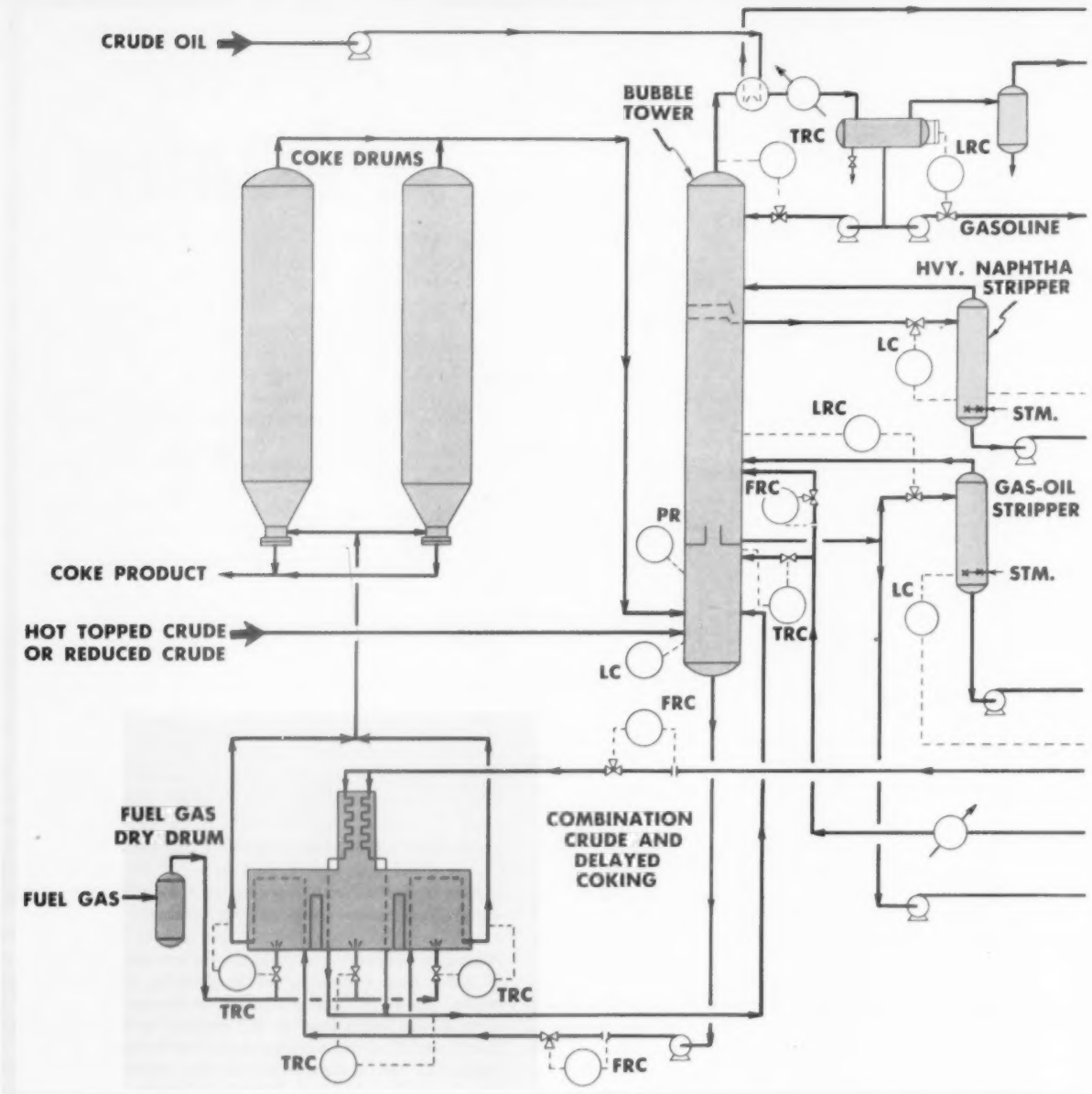
As shown in the flow chart, noncondensable gas and vented vapors from the condensing settling drums may be disposed of by discharging them through an ejector to a furnace. The final ejector discharges at slightly above atmospheric pressure, and can move the gas to any furnace within a reasonable distance. This trend toward so disposing of the gas is growing as a result of refiners' efforts to eliminate atmospheric contamination.

Design of heat-exchange equipment varies with operators' desires for waste-heat steam generation. Some prefer kettle-type boilers and others specify drum-type boilers. Steam from waste-heat boilers contains some moisture and can be dried and superheated in a coil in the convection section of the vacuum furnace, or it may be blended with superheated steam from another source.

Promotes economy . . . The use of a waste-heat boiler or of other heat exchange for condensing the bulk of the heavy gas-oil reflux promotes economy in recovering most of the latent heat of the product at a high-temperature level. This reduces the heat lost to cooling water in regulating the temperature of the reflux stream. The blending of residuum with cutter stock before cooling reduces its viscosity before final cooling to permit design of a smaller, less-costly cooler.

Controls on vacuum units vary widely, depending on local refinery practice. The flow chart indicates the average degree of instrument controls. For simplicity, all other instruments except control instruments are deleted from the chart. Temperature of the combined transfer line from the furnace is generally used to control the fuel to both furnace sections. Temperature indicators on the individual furnace outlet streams permit the manual adjustment of fuel to the two sides of the furnace from the control room in some units. The bypass around the trim cooler on the condensing reflux line is required to avoid overcooling which might result from variations in cooling-water temperature.

This discussion was prepared in cooperation with the M. W. Kellogg Co., New York, which has designed and constructed vacuum units in refineries throughout the world, among them the three largest in existence.



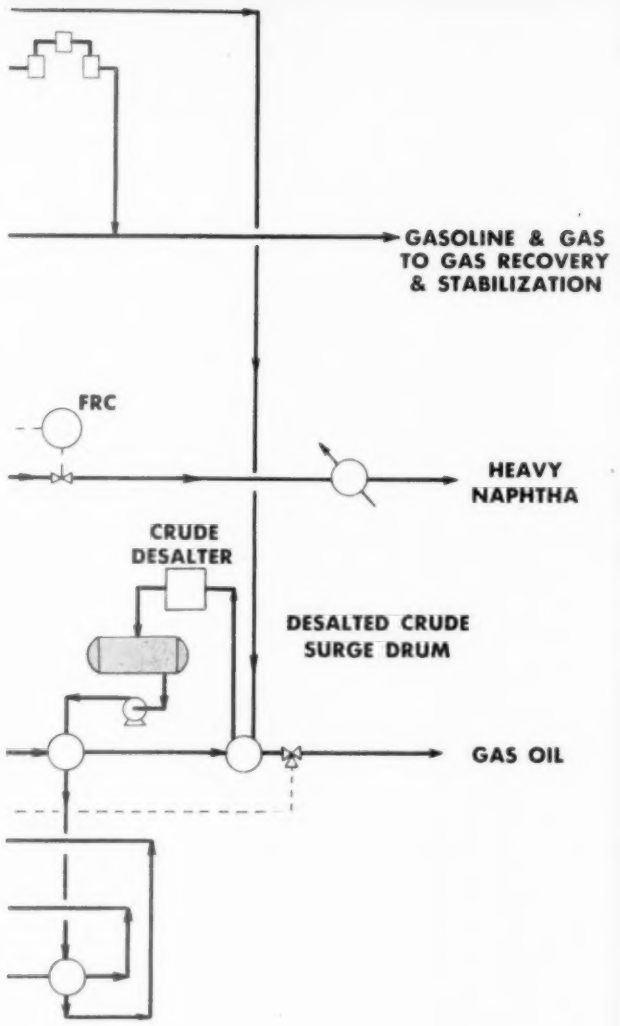
DELAYED COKING AND VISBREAKING

DELAYED coking is an established process for converting heavy residual hydrocarbons to lighter, higher-valued distillates and byproduct petroleum coke. In recent years this process has seen wide acceptance.

A total of 26 domestic refineries employ this process, with aggregate charging capacity of 273,000 bbl. per day, and a total coke-production capacity of 9,000 tons per day. Delayed-coking units in operation or under construction at the present time represent 80 per cent of total coking capacity in this country, the bulk of the remainder comprising older, less-efficient processes.

The modern delayed-coking process incorporates new advances which promote its efficient use in providing catalytic cracking feed stocks from topped crude. It is operated on a continuous throughput basis. Delayed coking differs from the conventional thermal cracking process in that the reduced crude is heated rapidly and flows to an insulated coking drum where it is coked by its own contained heat. Flow is alternated between two or more coke drums to permit removal of coke from one drum while the other is on stream.

In normal operation, reduced crude is first charged to the base of the delayed-coker fractionator. The hot bot-



toms fraction from this tower with any desired recycle stream is withdrawn to the furnace where it is quickly heated to 900° to 975° F. and charged directly to an insulated coke drum. The coke drum may be maintained at pressures ranging from 10 to 100 psi. Pressure and amount of recycle are governed by the end use of the distillate products. If maximum distillate production for catalytic feed stock is desired, lowered pressure and a low recycle ratio are employed.

Hydrocarbon vapors from the coke drum are charged to the fractionator for conventional separation into gas oil, furnace oil, naphtha, gasoline, and gas. Heavy ends are recycled to the furnace with the fresh reduced crude as desired.

Characteristics of the distillate products from delayed coking vary with the type of feed stock. In general, however, the gas-oil fraction makes high-quality catalytic feed stock. This is due to the fact that delayed coking is a relatively mild cracking operation, producing middle distillate stocks comparable to cracked or visbroken gas oils.

Delayed coking also produces a relatively low yield of solid petroleum coke. This product can be pulverized for burning in powdered form, and contains sufficient volatile combustible matter to support ignition without the auxiliary use of liquid or gaseous fuels. Delayed coke commands a ready market for the manufacture of electrodes used in producing aluminum, steel, and other metals. When produced from crudes low in sulfur and contaminating metals, the coke will bring a premium price.

Delayed-coking units have proved to be highly flexible in conforming to variable product markets. While reduced crude is the normal charge, whole crude can be charged with or without reduced crude as shown in the accompanying flow chart. In this example whole crude, after heat exchange with various hot streams, is desalted, and subsequently preheated in the center section of the combination furnace, after which it is flashed in the bottom section of the bubble tower.

The vaporized overhead products are fractionated with the coker products while the reduced crude with recycle and possible extraneous reduced crude added, is charged to the outside sections of the combination furnace. The mixture is brought to a temperature adequate to effect coking in the coke drums. Drums are usually sized for use in 24-hour cycles.

In areas where the price of heavy fuel varies, a delayed coker can be operated alternately for coking and for visbreaking. Conversion of a unit to visbreaking requires only the reversal of flow through the coke drums and slight variations in operating conditions.

This flexibility permits the operator to convert residual fractions to heavy fuel with a minimum requirement for cutter stocks, when the heavy-fuel market is attractive. When the returns from heavy fuel becomes uneconomic, delayed coking can be resumed. Byproduct coke can be stocked indefinitely at low cost.

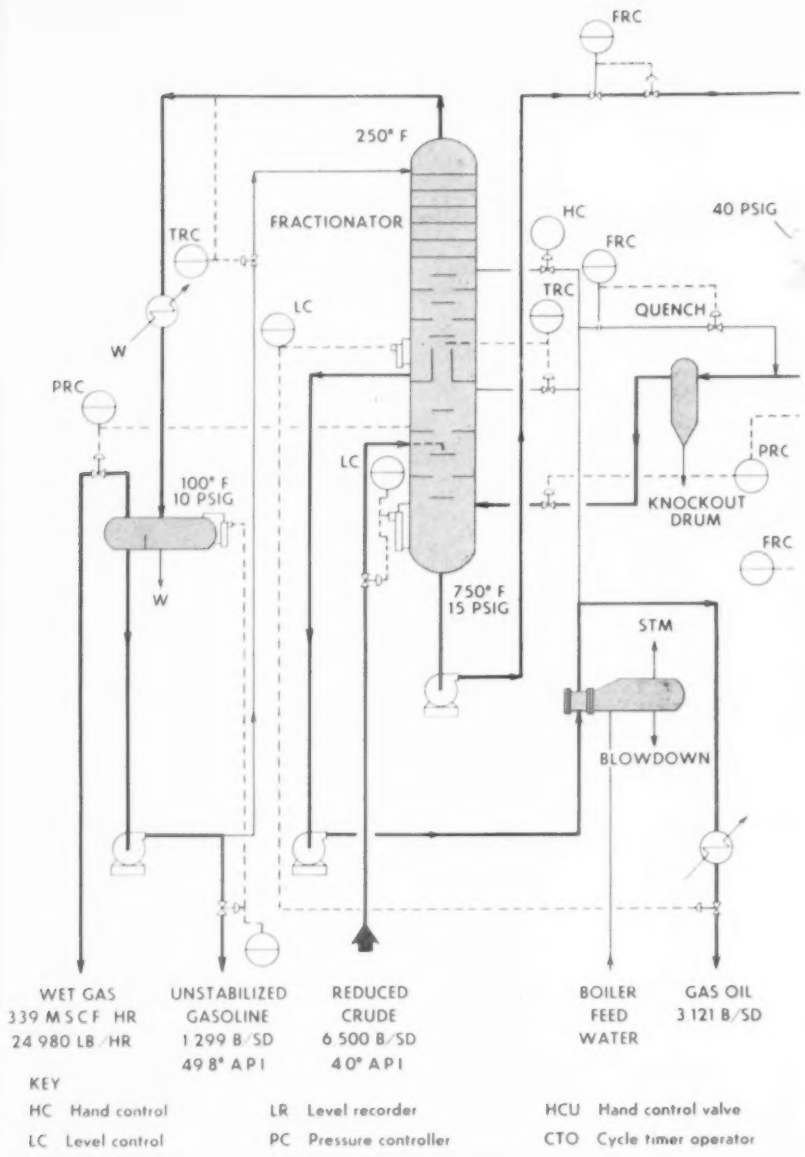
Delayed-coking furnaces are considered among the most difficult to design correctly. The objective is to reach the desired coking temperature as rapidly as possible, at the same time eliminating any coke formation in the furnace coil. This has been successfully accomplished as proved by the relatively long on-stream periods chalked up by delayed cokers.

This discussion was prepared in cooperation with M. W. Kellogg Co., New York, which licenses the delayed-coking process and has constructed the majority of such units in operation today.

TABLE 1—TYPICAL YIELDS OBTAINED BY DELAYED COKING

	Reduced crude				
	Mid-Continent	East Texas	Producers Calif.	South American	Kuwait
Reduced crude on crude, per cent	30	30	92.5	63	19
Conradson carbon	6.0	5.0	6.2	11.4	21.8
Yields, basis reduced crude:					
Gas, wt. per cent	4.0	4.7	4.8	6.9	9.2
Gaso. (400° e.p.-100 per cent Corr.) vol. per cent	19.0	21.0	12.2	20.6	28.0
Gas oil (875° e.p.) vol. per cent	74.0	70.0	76.5	63.4	37.3
Coke, wt. per cent	11.0	12.5	12.9	20.6	37.8

"The contact-coking process places no limitation on the volatility of the charge stock and handles any heavy tar or pitch that can be pumped to the unit."



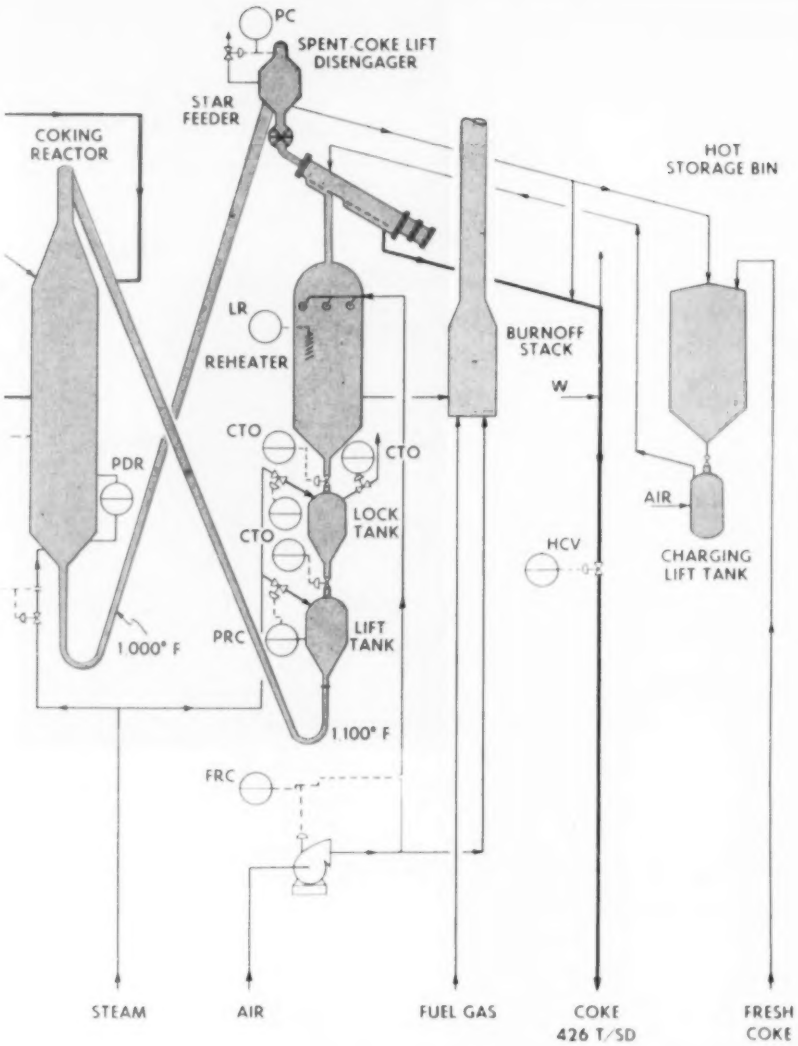
CONTINUOUS

THE continuous-contact-coking process possesses degrees of freedom in the areas of time, temperature, and pressure impossible to obtain by delayed-coking methods. The contact-coking process places no limitation on the volatility of the charge stock and handles any heavy tar or pitch that can be pumped to the unit.

In the operation of the unit, heated reduced crude is charged to the bottom section of the fractionator. Any material boiling in the desired product gas-oil range is directly distilled.

A stream of hot coke pellets is continuously circulated through the reactor vessel and the reheater. This circulation is obtained by means of mass lift with high-pressure steam as the motivating force. The bottoms from the fractionator are contacted with the reheated circulating coke at its entrance to the coking reactor.

In the oil-coke contacting zone the lighter portions of the oil are vaporized and the heavier unvaporized material is retained as a liquid film on the coke particles. The wetted coke particles flow by gravity movement through the reactor as a compact bed. In the reactor sufficient residence time is allowed to complete the coking and drying reactions. At an intermediate point in the reactor, the product vapors are removed through an



PRC Pressure recorder and controller
TRC Temperature recorder and controller
FRC Flow recorder controller
PDR Pressure differential recorder

CONTACT COKING

"A continuous-contact-coking unit, in combination with vacuum flashing to a heavy pitch, will produce a maximum of middle distillate, and more light distillates."

internal drawoff device and the coke descends below this vapor disengaging zone into a stripping zone where the final drying is obtained in an atmosphere of steam.

From the bottom of the reactor, the dried coke particles are elevated to the left disengager from which they flow by gravity through a classifier into the coke reheater. The reheated coke is discharged by gravity into the lock tank, which forwards it into the high pressure lift tank for recirculation back to the oil-coke contacting zone in the top of the reactor.

As oil is charged to the unit, successive increments of coke are deposited upon the circulating coke, resulting in a gradual increase in particle size and in the system's inventory. A classifier separates the large particles from the system as a product coke stream.

The product vapors from the coking reactor are fed to the bottom of the fractionator. Heat from these vapors distills the lighter components from the charge. The gas-oil product is withdrawn as a side stream from the column while gas and gasoline products are taken overhead.

Continuous contact coking is a new process for the upgrading of heavier residues than normally can be handled by the conventional delayed coking method.

A continuous contact coking unit, in combination with vacuum flashing to a heavy pitch, will produce a maximum of middle distillate, and thus provide a new tool to assist in meeting the industry's need for higher yields of middle and light distillates.

The inherent flexibility of the process permits processing stocks of widely different characteristics and, by varying the operating conditions, a much wider range of yields and product specifications are obtained than heretofore possible.

The process is continuous, and thus eliminates the intermittent cleaning of coke drums and attendant expense.

The product coke is clean, hard, uniform in size, and easily handled and marketed.

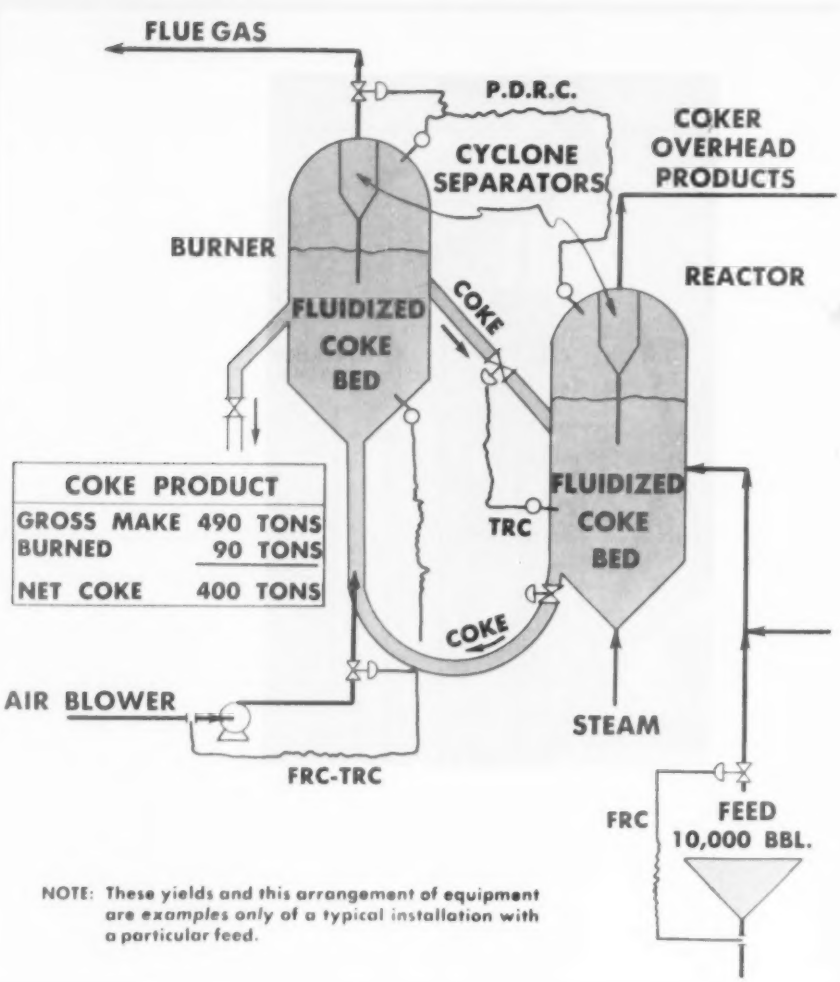
The capital investment and operating labor for a contact unit are less than for a delayed coking unit.

Engineering designs for a 2,500-bbl. per day unit are now being completed.

The continuous-contact-coking process is licensed by the Lummus Co., New York.

The continuous-contact-coking process is licensed by the Lummus Co., New York.

FLUID COKING PROCESS



NOTE: These yields and this arrangement of equipment are examples only of a typical installation with a particular feed.

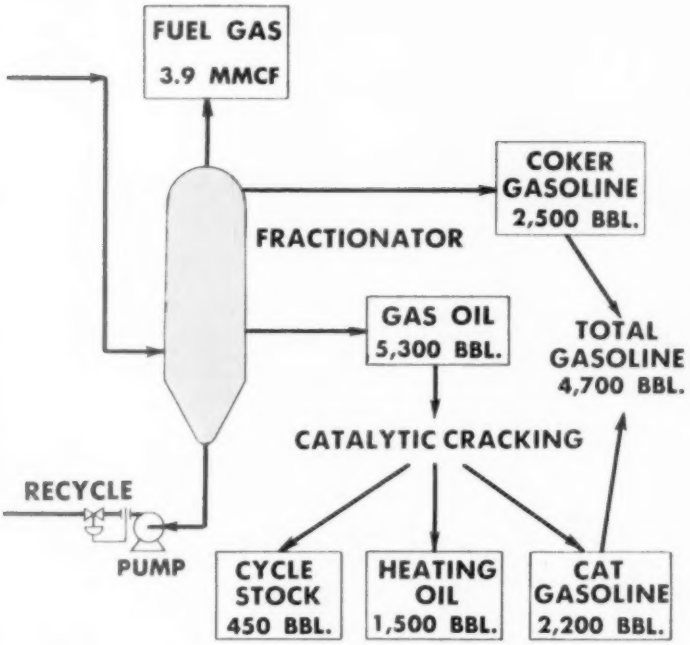
THE new fluid coking process was announced last August by Standard Oil Development Co., the central research, development, and engineering affiliate of Standard Oil Co. (N. J.). Standard Oil Development licenses the process. Two Jersey Standard affiliates, Carter Oil Co. and Esso Standard Oil Co., are proceeding with designs for fluid cokers, Carter Oil with a 3,800-bbl.-daily unit, and Esso Standard with a 10,000-bbl.-daily unit at its Baltimore refinery and a 21,000-bbl.-daily unit at the Baton Rouge refinery.

The fluid coking process offers many advantages to refiners, particularly those with a surplus of heavy residual oils which they cannot move at attractive prices, and those with sources of low-quality heavy crudes. Many of S.O.D.'s inquiries have come from small refiners in the Mid-Continent and West Coast areas, where the former are faced with a diminishing market and falling prices for residual oils, and the latter with an over-supply of the heavier crudes. The process offers refiners a method whereby they can convert these heavy oils into the economically more attractive lighter products such as gas oil and gasoline in a unit having a low initial investment cost and low operating costs. The continuous nature of the fluid coking process gives it considerable economic and operating advantages over previously available methods of coking.

The process itself is an adaptation of the fluidized-solids technique, in which S.O.D. has considerable experience, having pioneered its first commercial application to fluid catalytic cracking in 1942. In fluid coking, the feed stock is injected, without preheating, into a fluid bed of hot, finely divided coke particles in the reactor vessel. The coke particles supply the heat of reaction, the fluid nature of the coke bed insuring excellent mixing and a large available surface area for the coking operation. The coker overhead products are passed through a cyclone separator to remove any entrained coke particles, and leave the reactor to be fed to conventional fractionation equipment, where they may be separated into gasoline, gas oil, and a bottoms product which can be recycled to the reactor.

Coke is removed continuously from the reactor vessel to a steam stripper and is then fed through a standpipe system to the burner vessel with the aid of a fast-moving stream of air which is also utilized for combustion of some of the coke in the burner vessel. Hot, unburned coke is passed continuously from the burner back to the reactor vessel through a second transfer line to supply the heat of reaction. Excess unburned coke is withdrawn from the burner vessel continuously as a by-product.

The coke so produced by the fluid coking operation has value as a fuel for the refinery or for power-plant boilers and other industrial users. In many cases, de-



"The fluid-coking process offers many advantages to refiners, particularly those with a heavy surplus of residual oils which they cannot move at attractive prices, and those with sources of low-quality heavy crudes."

pendent upon the feed stock, the coke may have considerable value in the production of carbon electrodes for the aluminum industry. S.O.D. is presently carrying out research work into the end uses and application of the coke produced in the fluid coking operation.

The accompanying table shows comparative data on the yields and product quality of estimated fluid coking and delayed coking of California residuum.

Coke yields are close to the Conradson carbon of the original feed. This is another way in which fluid coking differs from delayed coking. In the latter process, coke yields are closer to twice the Conradson carbon.

Hydrogen and volatile-matter content of the coke produced by the fluid-coking process are quite low. This is an indication of the calcination which takes place in the burner vessel.

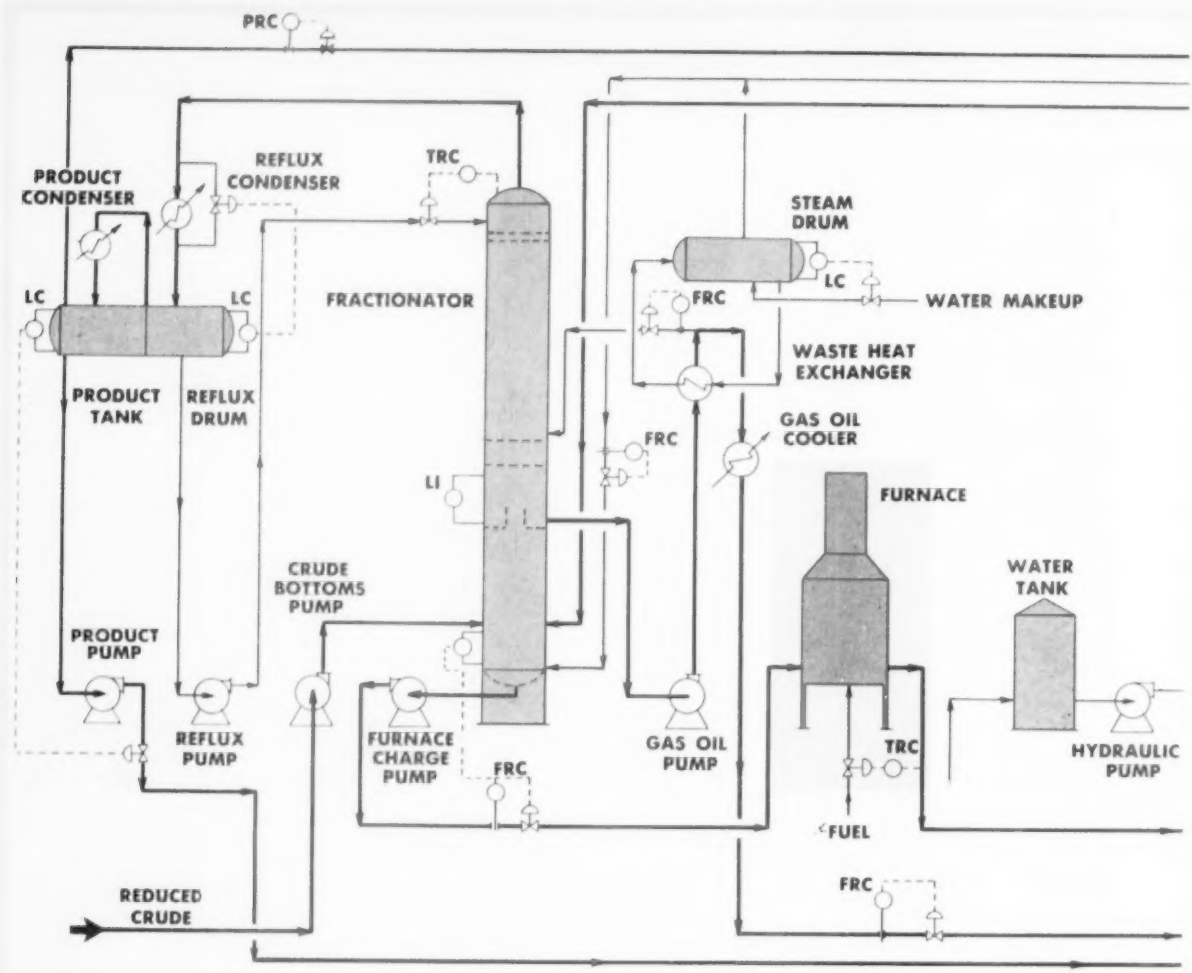
Fluid-coking coke has some interesting and unique properties. Its fine, but uniform, particle size makes it easily handled as a fluid, but, nevertheless, it is a clean, dustless solid. The roundness of the particles is a property which may make possible some unique applications.

Standard Oil Development Co. began research work on fluid coking about 4 years ago, and at the Esso Laboratories in Baton Rouge, a 100-bbl.-a-day pilot plant has been operating successfully as a fluid coker for over a year. Excellent results have been obtained with this unit using a wide variety of feed stocks.

FLUID AND DELAYED PILOT PLANT COKING OF VACUUM RESIDUUM FROM CALIFORNIA CRUDES

	Yields	
Feed—		
Gravity, °A.P.I.	5.6	
Conradson carbon, weight per cent	22.5	
Sulfur, weight per cent	1.7	
	Estimated fluid	Tide Water delayed coking
Coke, weight per cent	26	40.2
C_3 and lighter, weight per cent	7	9.2
C_4, volume per cent	2.2	3.4
Debutanized naphtha, volume per cent	*16.5	†28.2
Gas oil, volume per cent:		
400°-750° F.		31.5
430°-1,015° F.	59	
Total C_4+ liquid, volume per cent	77.7	63.1
Gas oil:		
Yield, volume per cent	59	31.5
Gravity, °A.P.I.	16	29.3
A.S.T.M. distillation, °F.:		
I.b.p.	480	431
50 per cent	845	525
90 per cent	1,000	660
Sulfur, weight per cent	1.2	0.9
Characterization factor	11.3	11.3
Naphtha:		
Yield, volume per cent	16.5	28.2
Gravity, °A.P.I.	55	59.3
C.F.R.-R. octane number, clear	76	66
Sulfur, weight per cent	0.6	0.6
A.S.T.M. 90 per cent point, °F.	370	334

*C_5—430° F. V.T. (A.S.T.M. 90 per cent = 370° F.).
†A.S.T.M. 90 per cent = 334° F.



DECARBONIZATION

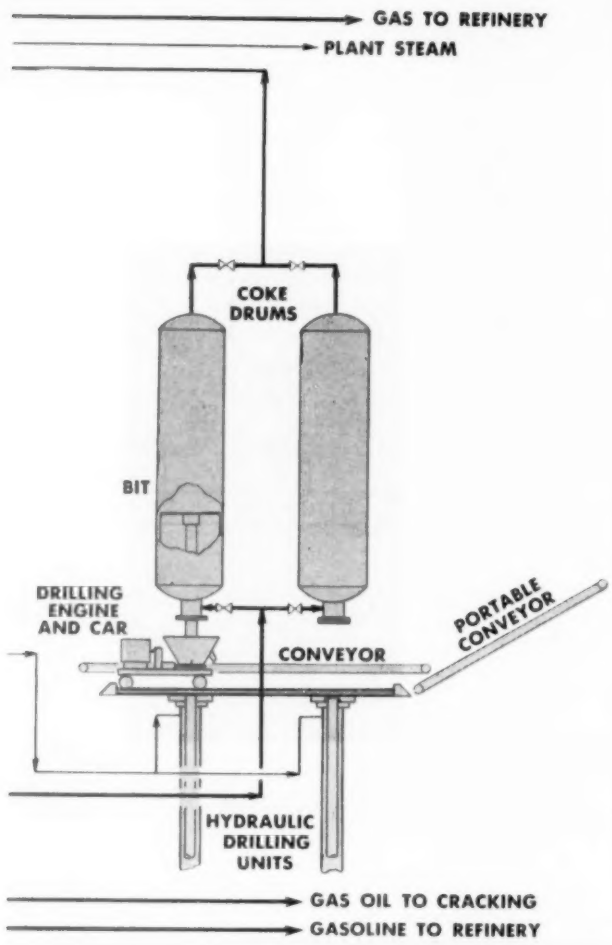
THE decarbonizing unit is designed to process a reduced crude and produce a high yield of clean (low-Conradson-carbon) catalytic cracking feed stock. The process also produces a controllable yield of high-grade petroleum coke, useful as a raw material in certain chemical process industries.

The hot reduced crude charged to the decarbonizing unit is pumped into the base of the fractionator. A portion of the fresh feed is flashed in the base of the fractionator by the addition of stripping steam and the heat supplied by the coke drum effluent. This insures maximum vaporization of the fresh feed and minimum charge to the coke drums.

The fractionator bottoms stream is pumped through a furnace. From the furnace the charge flows to one of the coke drums. Vapor and liquid enters the bottom of the coke drum and vapor leaves the top. The liquid remains in the coke drum and is converted to coke, under the time-temperature conditions which prevail there. In the usual two-drum installation, one coke drum is in coking operation while the other is being decoked. Mechanical decoking equipment of least complexity is provided for coke removal. The coke drums can be sized for 24-hour cycles so that only one decoking crew will be required each day.

The vapors from the coke drum flow to the base of the fractionator. The gas oil is condensed and withdrawn from a well-type tray. Gas-oil product plus intermediate reflux is pumped through a waste-heat-exchanger generating process and utility steam. Stripping steam, gas and gasoline are taken overhead and cooled to condense the gasoline product plus the necessary reflux. The coke drum and fractionator are operated at pressures consistent with the desired product distribution between coke and distillate.

In the usual operating cycle, the full coke drum taken off stream is steam stripped. After steam stripping, the coke is cooled with water. Water is added to the bottom of the drum and the steam formed is vented to the blowdown stack. After cooling, the water is drained. The decoking crew unheads the coke drum and positions the drilling engine. Coke drilled out falls out the bottom of the coke drum and is funneled on to a conveyor belt



PROCESS

which carries the coke to a pile or directly to railroad cars. After coke removal, the drum is headed up and preheated with hot oil vapors before being placed on stream. Variations in decoking procedure and cycle can be used to accommodate special refinery situations, or to produce certain desired coke properties.

The salient features of the operation are maximum coker distillate for catalytic cracking, minimum coke, and coker gasoline. This, therefore, is basically a feed preparation system for catalytic cracking, running to coke, so it is termed "decarbonizing" to distinguish it from conventional coking processes.

A typical economic analysis of the process as applied to decarbonizing East Texas reduced crude is shown in Table 1.

TYPICAL YIELDS FOR LIGHT AND HEAVY RESIDUUM
(Blaw-Knox Decarbonizing Unit)

Charge	East Texas	Mid-Continent
Reduced crude, bbl. per day	10,000	10,000
Reduced-crude Inspections		
Gravity, °A.P.I.	26.0	14.4
Carbon residue	3.98	12.2
Yields		
Gas M.s.c.f.d.	825	2,750
Gasoline, bbl. per day	563	1,300
Gas oil, bbl. per day	9,060	7,040
Coke, tons per day	79	280

TABLE 1—ECONOMICS FOR BLAW-KNOX DECARBONIZING PROCESS

Charge: 10,000 B/D 26° A.P.I. East Texas Reduced Crude
Investment $1,000,000

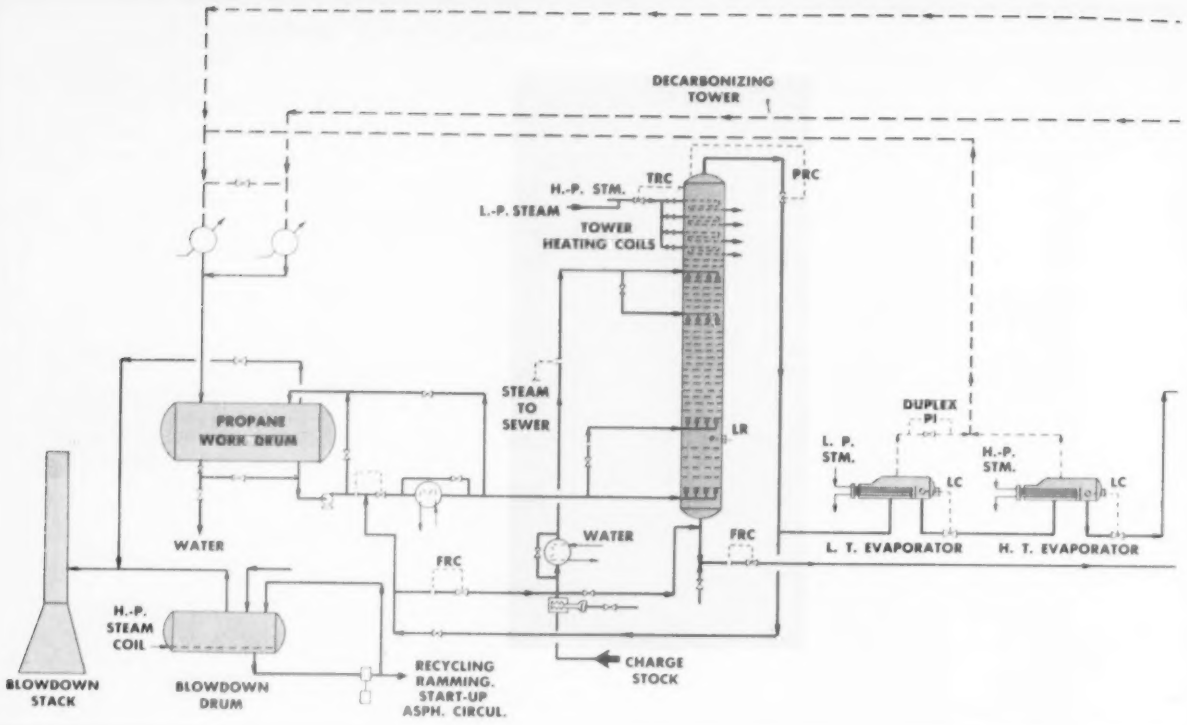
Operating costs:	**$/day**	**cts./bbl.**
Utilities (steam, fuel, power, and water)	286.00	2.86
Labor: Operating, decoking and supervision	220.00	2.20
Taxes and insurance (3 per cent of investment)	82.00	.82
Maintenance (5 per cent of investment)	138.00	1.38
Administration and overhead (90 per cent of labor plus maintenance)	322.00	3.22
Amortization (15 years)	183.00	1.83
Total	$1,231.00	12.31

Value of products:*	**Quantity**	**$/day**
Gas	825 M.s.c.f./D	82
Gasoline	563 B/D	2,130
Gas oil	9,060 B/D	29,100
Coke	79 T/D	394
Total		$31,706

Value of decarbonizer charge stock:	
Value of products	$31,706
Less operating costs	1,231
Net value of reduced crude	$30,475
Value per barrel of reduced crude	$ 3.05

***Basis:**	
Gas, cents per M.c.f.	10
L.P.G., cents per gal.	5
Gasoline:	
Coker, cents per gal.	9
Cat. cracked, cents per gal.	11.5
Poly., cents per gal.	11.5
Light cycle oil, cents per gal.	7
Heavy cycle oil, cents per bbl.	95
Coke, ton	$5.00

The decarbonizing process is offered by Blaw-Knox.



PROPANE DE

PROPANE decarbonizing is a solvent-extraction process employed to recover an additional fraction of catalytic cracking feed stock from crude residua. This process shows promise of wider commercial application due to its advantages over other methods for converting substantial portions of residual fractions to higher-valued feed stocks and minimizing heavy-fuel production.

The moderate temperature at which the lower-carbon-residue fraction is separated from the heavy asphaltic components precludes any thermal decomposition and provides superior stocks for both catalytic cracking and asphalt manufacture. The process is flexible and can be used in conjunction with other well-known methods for processing heavy crude bottoms. It can be employed to reduce the fraction containing heavy asphalt and metal contaminants, to a very low percentage of original crude.

The process is based on the same principle as propane deasphalting for recovery of high-quality lubricating oils, but employs different solvent ratios and operating conditions. The term "decarbonizing" is used to distinguish that operation designed for recovery of a clean residual fraction for catalytic cracking.

As shown in the accompanying flow chart, the process is relatively simple. The bottoms stream from crude distillation is reduced in temperature by heat exchange and cooling and is charged to the decarbonizing tower. Liquid propane introduced near the bottom of the tower is intimately contacted with the heavy-oil charge. A system of baffles and the provision of a temperature gradient by means of steam coils near the top of the tower, provide for the fractionation of the charge oil into the two desired cuts.

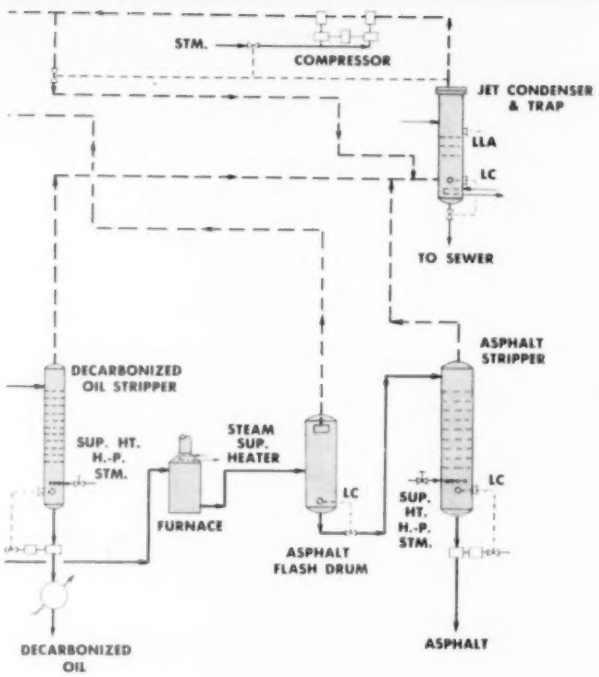
The depth of the cut is determined by the type of charge stock and the desired specifications of asphalt or total cat cracker feed of which the decarbonized oil is a part. The propane-decarbonized oil solution withdrawn overhead is heated in evaporators with exhaust steam for removal of most of the solvent. The remaining propane is recovered with steam in the decarbonized oil stripper.

The asphalt-propane solution withdrawn from the bottom of the decarbonizing tower is heated in an asphalt furnace, and propane is similarly recovered in a flash drum and stripper. Flux oil may be blended with the heavy depropanized asphalt before pumping to heavy fuel storage, or the uncut fraction may be withdrawn directly for asphalt finishing or visbreaking.

Propane loss from the system is negligible. Propane vapors at high pressure are condensed by cooling and moved directly to working storage. Residual propane vapors and steam from the two strippers pass through a condenser for water removal and the remaining propane is compressed, condensed and returned to working storage.

Temperature and pressure conditions in the decarbonizing tower vary with the type of charge and the desired degree of separation. Normally, using propane as a solvent, the temperature at the top of the tower will vary between 160° and 190° F. Operating pressure may range from 450 to 600 psi.

Two recent developments augment the attractiveness of this process for recovering additional heavy fractions for catalytic cracking. Recently developed information has deemphasized the carbon residue of feed stock as an important limiting factor. Hence, deeper cuts into the residual fraction are now recognized as desirable, and the remaining criterion on catalytic feed is the content of metal contaminants. The ability of the decarbonizing process to reject a very large proportion (96 to 99 per



CARBONIZING

cent) of these contaminants to the asphalt phase is an important feature of the process.

Another development which extends the application of the decarbonizing process is the introduction of butane as a solvent agent. Butane offers more solvent power than propane and is particularly advantageous in extracting decarbonized oil from very heavy, highly contaminated residua. With technical know-how gained from years of design experience, it is now possible to tailor the solvent to the job to be done. In view of these technical advances, the solvent decarbonizing process now appears to be economically attractive even when used following vacuum distillation.

Short residua can now be decarbonized to yield as much as 40-70 per cent of clean catalytic charge stock and very high-melting asphalt. When catalytically cracked the additional virgin fraction recovered from residua by this method shows a substantially improved yield-quality relationship as compared with heavy fractions derived from processes entailing thermal decomposition.

A high-grade straightrun asphalt product results from decarbonizing. If desired, this heavy-asphalt fraction can be visbroken so as to require a minimum of cutter stock and thus further reduce heavy-fuel production.

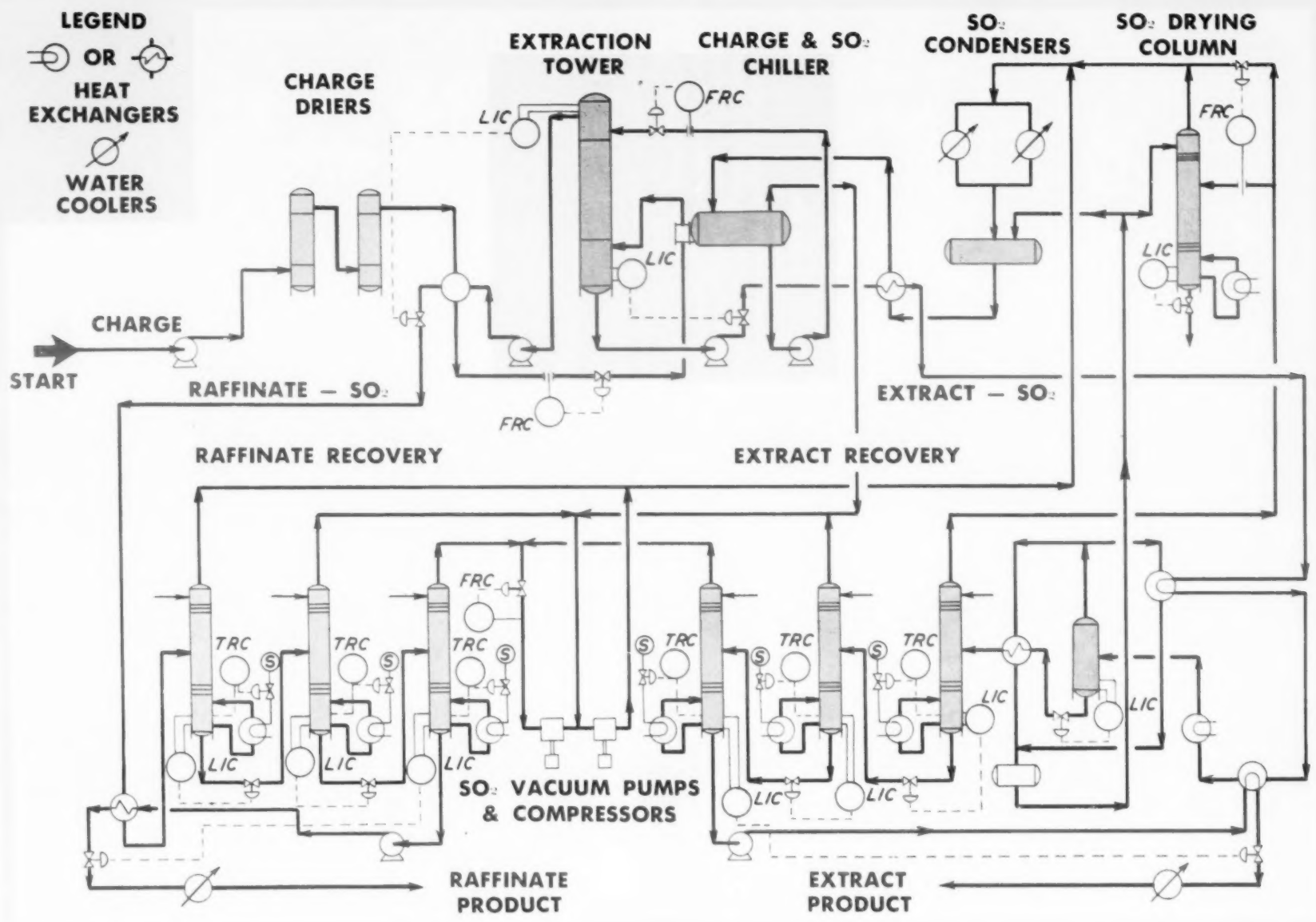
The flexibility of the process will permit its alternate use, on a blocked-out operation, for deasphalting of residual stocks for lubricating oil manufacture. It is only required in such use to adjust the charge-oil rates to give the desired solvent ratios for each operation.

At present, five propane decarbonizing units with a total capacity of about 63,000 bbl. per day are in operation in this country. In addition, a number of new units are now in the planning stage. These units are distinguished from the 20 propane deasphalting units with aggregate capacity of 63,000 bbl. per day.

M. W. Kellogg Co., of New York, licenses the propane decarbonizing process.

TYPICAL DECARBONIZING RESULTS

Reduced crude:	A	B	C	D	E	F	G
Volume per cent crude	11.1	19.8	22.2	32.3	29.2	20.0	16.0
Gravity, °A.P.I.	11.3	13.0	5.3	10.1	12.0	6.3	9.6
Conradson carbon, weight per cent	15.0	13.3	21.5	16.0	12.1	22.2	18.9
S.U.s. at 210° F.	2,193	812			526		
S.F.s. at 210° F.			772	162		990	179
SiO_2-free ash, p.p.m.	489	149	350	237	936	848	265
Metals, p.p.m.:							
Vanadium	23.1	27.6	84.1	61.6	27.6	136.0	30.9
Nickel	14.2	11.9	27.6	19.9	16.0	139.0	46.6
Iron	18.2	56.6	13.2	6.7	13.2	93.0	39.3
Copper			3.7	0.8	1.6	0.04	1.4
Decarbonized oil:							
Volume per cent charge	62.9	69.0	35.0	47.0	66.0	52.8	67.8
Gravity, °A.P.I.	19.0	20.5	19.3	20.3	19.6	18.3	17.8
Conradson carbon, weight per cent	4.2	2.6	4.3	2.6	2.2	5.3	5.4
S.U.s. at 210° F.	294	163	193		113	251	250
SiO_2-free ash, p.p.m.	9.2	8.9	8.8	7.6	6.2	25.5	10.7
Metals, p.p.m.:							
Vanadium	1.23	0.36	1.88	0.73	1.34	2.3	1.4
Nickel	1.10	0.56	0.92	0.38	0.99	8.1	3.9
Iron	0.49	0.90	0.96	1.70	0.66	3.5	Trace
Copper			0.03	0.04	0.15	0.03	0.02
Asphalt:							
Volume per cent charge	37.1	31.0	65.0	53.0	34.0	47.2	32.2
Specific gravity	1.076	1.086	1.087	1.059	1.083	1.119	1.120
R & B soft. pt., °F.	188	196	142	132	171	246	224
Per cent of metals in reduced crude rejected to asphalt fraction	97.1	98.8	99.1	98.6	96.6	98.2	97.1


LEGEND
OR
HEAT EXCHANGERS
WATER COOLERS
CHARGE DRIERS
EXTRACTION TOWER
CHARGE & SO2 CHILLER
SO2 CONDENSERS
SO2 DRYING COLUMN
LIC
FRC
TRC
CHARGE
START
RAFFINATE — SO2
EXTRACT — SO2
RAFFINATE RECOVERY
EXTRACT RECOVERY
SO2 VACUUM PUMPS & COMPRESSORS
RAFFINATE PRODUCT
EXTRACT PRODUCT

SO_2 EXTRACTION OF GAS OILS

CATALYTIC cycle oils are upgraded by extraction with liquid SO_2 to produce high-quality diesel fuels or improved catalytic cracking feed stocks. The improvement comes from the reduction in the aromatic and olefin hydrocarbon content with simultaneous reduction in the amount of sulfur, nitrogen, and oxygen-bearing substances. These materials are concentrated in an extract fraction which is excellent as a cutter stock for heavy fuels or for special uses, such as an aromatic solvent for herbicides and insecticides, as plasticizers and softeners for natural and synthetic rubbers and for the production of carbon black.

The raffinate fraction may be used as a premium diesel fuel or furnace oil, or as recycle to the cracking unit. When used as recycle, it permits an increase in the fresh-feed rate to the cracking unit and results in increased gasoline production of lower sulfur content. As a diesel fuel, it enjoys the advantage of high cetane number in addition to low exhaust odor and smoke, and low engine deposit.

SO_2 extraction plants to treat cycle oils are similar to those for the treatment of kerosines and diesel fuels and, in some cases, a single unit treats each of these products separately in blocked-out operations. Other units are designed to treat cycle oils exclusively and in these certain economies in design are possible. In a plant treating a cycle oil at a relatively high temperature (80°-100° F.), it is not necessary to provide the conventional cold exchange and, in some cases, a single-stage contactor may be used in place of a countercurrent extraction tower. Further simplification is possible by the elimination of the feed-drying facilities.

The accompanying diagram illustrates the flow in a unit designed for maximum flexibility of charge stock, particularly for the range of kerosines through heavy catalytic cycle oils. In this plant the dried feed stock is cooled and then extracted with liquid SO_2 in a countercurrent extraction tower. The raffinate product from the extraction tower is completely stripped of its dissolved SO_2 in a series of three evaporators operating at successively lower pressures and higher temperatures. The SO_2-free raffinate is then suitable for recycling to a catalytic cracking unit or, after freeing of traces of dissolved SO_2 by air blowing or neutralization, it may be used as fuel. The extract fraction, that portion of the oil which is soluble in the SO_2, is similarly stripped of its SO_2 by a series of four evaporators. The SO_2 removed from each oil fraction is condensed, partly with the aid of compressors, so that it may be reused in the extraction. The compressors also provide any necessary refrigeration. Water which would tend to build up in the solvent is removed by a small drying column.

Extraction of catalytic cycle oils generally requires a solvent dosage of 50-100 per cent of the feed by volume. For maximum yields of raffinate, fewer extraction stages are used, which results in a lower-quality raffinate for a given solvent dosage. The temperature of extraction varies from 0° to 80° F., depending on the pour point of the cycle oil and the requirements of the extraction. At normal conditions the raffinate will have an aromatic plus olefin content of 5 per cent to 10 per cent by volume, with an extract of 75 per cent to 85 per cent aromatic plus olefin content. The yield of raffinate will vary with the aromatic content of the cycle oil.

The accompanying table shows typical treating conditions, yields and inspections of the charge and products of the SO_2 extraction of a heavy, waxy, catalytic cycle oil. Approximately one and one-half extraction stages were required for this raffinate purity. Higher raffinate purity could be obtained by using additional solvent or extraction stages at the expense of raffinate yield.

The SO_2 extraction process is licensed by Stone & Webster Engineering Corp., Badger Process Division, Boston.

TABLE 1—SO_2—75 VOLUME PER CENT TREATING TEMPERATURE—80° F.

	Catalytic cycle oil	Raffinate	Extract
A.S.T.M. distillation, °F.:			
I.b.p.	522		
10 per cent	601		
50 per cent	663		
90 per cent	731		
E.p.	760+		
Pour point, °F.	70		
Gravity, °A.P.I.	27	37.7	8.1
Yield, volume per cent	100	69	31
Sulfur, weight per cent	1.1	0.5	
Aromatics and olefins, volume per cent	30.0	8.5	78.0
Bromine number	7.8	2.8	11.8
Aniline point, °F.	172	209	65

At the Borger, Tex., refinery of Phillips Petroleum Co., unconverted gas oil from the F.C.C. unit goes to the sulfur dioxide solvent-extraction unit which has been on stream since December 1951. This unit was installed to convert catalytic cycle oil to high-quality catalytic cracker feed stock by extracting objectionable constituents. The extract is aromatic in nature with an aniline point varying around 0° F.

The gas-oil raffinate from SO_2 extraction is charged to both the Cycloversion catalytic cracking and the F.C.C. units. The Cycloversion operation is conducted in a fixed-bed four-chamber unit. A No. 2 heating-oil cut is produced (furnace oil) in addition to gas and gasoline. Unconverted gas oil is recycled to SO_2 extraction.

MORE REALIZATION FROM THE BOTTOM OF THE BARREL

The selling price for residual fuel is about one-third that of crude oil. This wide differential means that the only practical way to alleviate this problem in the near future is to reduce the output of these residuals. The Journal's refining editor here discusses in three comprehensive articles the three most logical ways to accomplish this end, and the economics of each. These are:

1. Process residual to obtain cat cracker feed stock.
2. Produce asphalt.
3. Produce coke.

1. HEAVY FUEL OIL . . .

Its yield must be reduced, since it appears destined to remain an economic stepchild and in byproduct class

by George Weber
Refining Editor

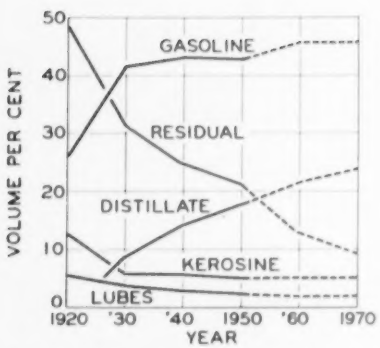


Fig. 1—The trend in petroleum product yields in United States refineries, expressed in volume per cent of total crude run to stills.

RESIDUAL products from petroleum have historically commanded prices appreciably below those for most other petroleum products. For many years in fact, heavy-fuel-oil prices have been lower than the cost of the crude raw material itself, and residuals in general have been relegated to the status of byproducts.

Both the price structure for heavy fuel and the end use pattern have fluctuated widely during the past several years. Some fairly spectacular market losses to gas and diesel fuel have been offset by rising demand for this type of fuel from other consumer classes.

But there is no indication that the depressed price position for residual fuels will improve to any great extent. Much of the current market remains only so long as the price continues competitive with other fuels. Thus tied to the price structures of competitive fuels, residuals stand apart from most other petroleum products and are likely to remain in the byproduct class.

Hence, refiners will continue to employ process improvements to convert more and more of this residual fraction to the distillate products which show a profit. This underlying economic incentive for turning more residuals into distillates has become a matter of dire necessity for some refiners whose heavy-fuel outlets have all but disappeared.

While improved refining techniques permit the refiner to whittle away at his yield of low-valued heavy products, few operators have arrived at the irreducible minimum of residual production. The erratic demand pattern for heavy fuels in many areas imposes the need for constant evaluation of present and potential consumers for this product.

It is hazardous to forecast demand for the many end uses of this fraction. However, certain trends are evident in the projected demand from many classes of consumers.[1 2 3] In addition, mechanical improvements and new techniques in many fields hold promise of developing heavy-fuel demand where little or none exists today.

As a result, the so-called "residual problem" is two-pronged. It can be alleviated in the first place by carrying the residual-to-distillate conversion to economic limit.

In addition, the refiner's net return from his remaining heavy fraction might be improved by a constant study of demand possibilities within his market area. In this respect he may find adaptable some new developments practiced by other refiners and their customers.

There are presently a number of signposts along these dual approaches to the problem of realizing more from the residual petroleum fraction. This special report points to new processing developments which will enhance the return from residuals, and reviews some of the progress now being made in improving and extending the market for heavy fuels.

Trends in Residual Yields

With the exception of such extraordinary events as World War II, the over-all yield of residual petroleum products has continued consistently downward for the past several decades. Underlying this trend was the sustained growth in demand for gasoline, later

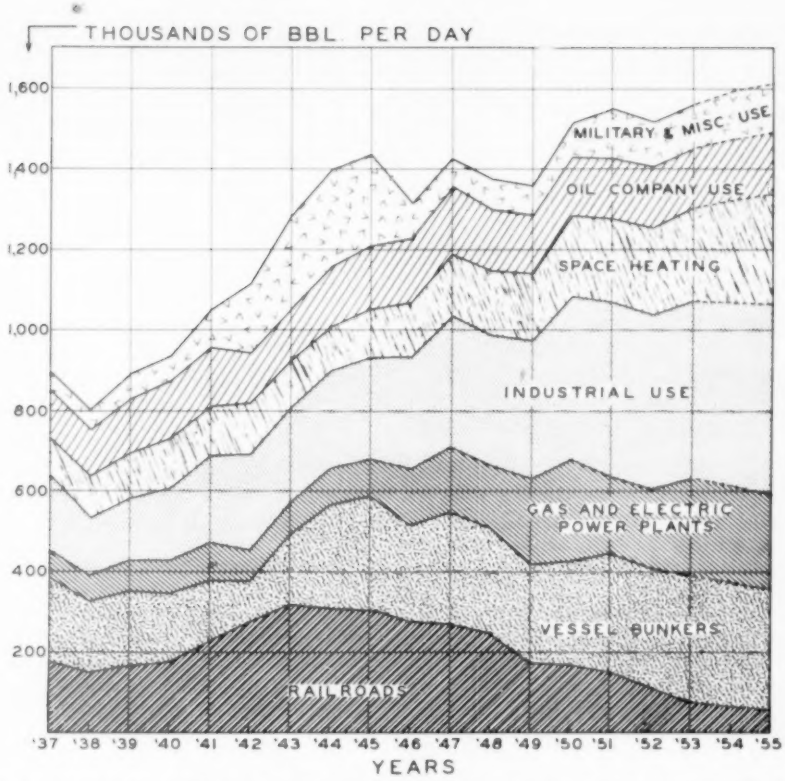
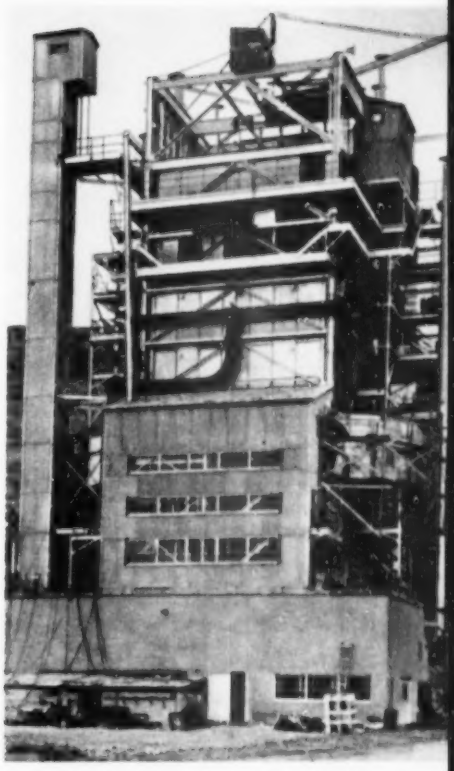


Fig. 2—The end use pattern for heavy residual fuel oils, showing estimated consumption to 1955. (Source of data to 1952: Bureau of Mines.)



Large electric power stations represent important potential customers for heavy fuel oil. The Frank W. Bird steam-electric station of the Montana Power Co. at Billings, is representative of the modern high-temperature steam units being built throughout the country.

joined by an upsurge in the consumption of middle distillates in diesel engines and home-heating systems. In contrast, the market for heavy fuels has lagged.

These events led to the transition of refining techniques from the straight-run distillation process, to its combination with thermal cracking, vacuum distillation, catalytic cracking, and many other processes aimed at increasing distillate yields and product quality.

Fig. 1 illustrates the trend in the yields of the principal products from petroleum in this country. Prior to 1920, the bottom of the barrel represented that fraction which could not be vaporized under normal atmospheric pressure in crude stills. Representing roughly half of the original crude, this heavy-fuel fraction yielded first place in product volume to gasoline during the 1920's.

The investment of billions of dollars during the past 20 years has reduced this residual fuel oil to an over-all yield of 17.6 per cent of total crude run to stills in this country last year. In 1951, residual fuel oil yielded second place in volume to distillate fuel oils excluding kerosine.

The projection of these relative yields indicates that by 1960 the residual fraction will decline to about 12 per cent of all crude processed, and that by 1970 production should dip below the 10 per cent mark.[4] This forecast assumes a continuation of peacetime demand factors and the continued installation of processing facilities which will permit the upgrading of fractions which both physically and economically represent the bottom of the barrel.

Processing

More value from residuals . . . The forecast that the national yield of residual fuel oil may drop to 9 per cent of crude runs by 1970, is considered a sound one.

The yield reduction on a national scale will probably incorporate few new or different processes, but will result from a broader application of existing ones. It will result from the addition of new processing units at many refineries, and from the improved operation of current facilities through application of better operating techniques.

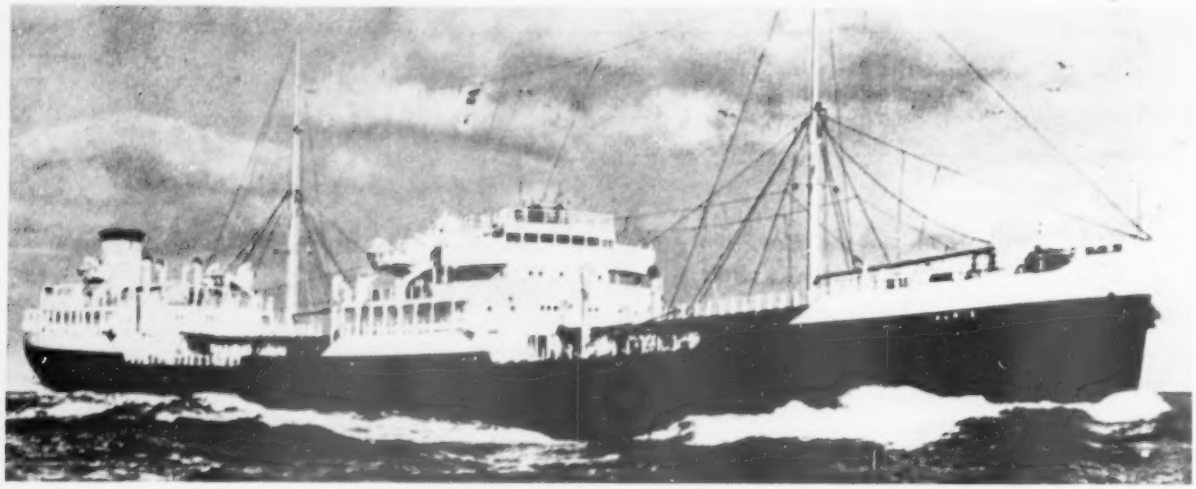
The special Processing Section of this issue of The Oil and Gas Journal focuses on those techniques available to the refiner in converting more of the residual fraction to higher valued distillate products. Going beyond a mere discussion of stream flow this section spotlights recent developments in both new and established processes.

Vacuum distillattion . . . The reduction of residual yields to the current level reflects a growing trend toward deeper distillation of reduced crude under vacuum. Improvements in catalytic cracking technique now permit the use of heavier feed stocks than were believed advisable a few years ago. In fact, the carbon residue of catalytic feeds is no longer as important a limiting factor as formerly. Now, refiners can dip further into the reduced-crude fraction for this important feed stock, with total content of metal contaminants their principal remaining limitation.

At present, the capacity for reduced-crude distillation under vacuum is estimated at about 28 per cent of basic crude capacity in this country. This ratio of capacity is steadily gaining as refiners adopt vacuum distillation and as others expand their employment of this useful tool.

Some refiners with existing vacuum distillation equipment can improve their operation by taking advantage of recent developments. In some cases higher coil outlet temperatures, high transfer rates, and lower fractionator pressures can improve the overhead yield for catalytic cracking.

The use of knitted-wire-mesh sections



The tanker "Auris" is the first gas-turbine-powered merchant ship. This tanker, owned by Anglo Saxon Petroleum Co., is bunkered with any available fuel of the desired viscosity classification, and has successfully burned high-sulfur, high-vanadium residual fuels. Photo courtesy of Shell Oil Co.

to prevent the entrainment of heavy liquid droplets into the upper sections of the bubble tower has proved particularly beneficial in many cases. Extension of these techniques permit more efficient operation of catalytic cracking units and improved recovery of heavy distillate stocks from the residual fraction.

Coking . . . Many new developments are under way in the coking of residual fractions, reflecting a keen interest in this process on the part of many refiners. Coking can in many cases completely eliminate production of heavy liquid fuels. From the several processes now available, the refiner can choose that best adapted to his particular case. Coking can be employed as a balance wheel, to adjust refinery yields to conform to varying market conditions.

The high interest in this process is reflected in the fact that coking capacity in this country today stands at an all-time high. Refiners now have an aggregate capacity for charging 278,000 bbl. per day to coking units, with additional charge capacity of 90,000 bbl. per day either under construction or firmly planned.

Visbreaking . . . As practiced for many years, the visbreaking process has been adapted to the thermal cracking of topped or reduced crudes at various degrees of severity to produce gasoline, gas oil, and heavy fuel oil. More recently the process may be said to have narrowed to some extent to perform more exactly what its name implies—the reduction in viscosity of a heavy residual to produce a heavy fuel meeting viscosity specifications, with some attendant production of gasoline and gas oil.

In this respect, visbreaking is a mild form of thermal cracking which is well adapted to the processing of the shorter residual fractions resulting from deeper vacuum distillation and propane decarbonizing. By so reducing the viscosity of a heavy denuded fraction, the refiner avoids the degrading of higher-valued distillate stocks otherwise necessary to cut it back to fuel-oil specifications, and minimized net production of heavy fuel. More severe cracking produces more gasoline and gas oil, but the gasoline is not a high-octane product and the gas oil being more refractory makes poor catalytic feed stock.

The use of radiant furnaces and the careful control of coil outlet temperature, pressure, and residence time have improved the visbreaking process when applied to high-viscosity residuals resulting from deep vacuum distillation.[5] The visbreaking operation may also be conducted with delayed coking units by reversing the flow through the coke drums and properly adjusting pressure and temperature. This alternate process permits the refiner to adjust his processing to meet variations in demand for heavy fuel oil and distillate products.

Total visbreaking capacity in this country is difficult to pin point, since many units can be operated alternately for other thermal processes. Usable visbreaking capacity is believed to range between 6 and 8 per cent of crude capacity at the present time.

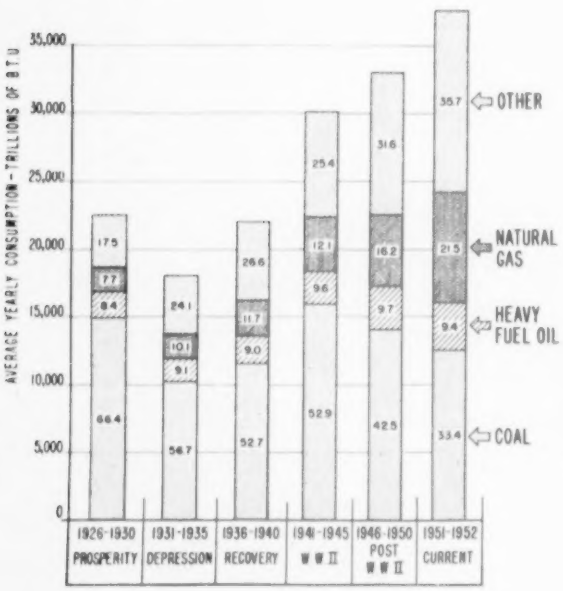


Fig. 3 — United States energy consumption of major fuels. Figures represent percentages of total consumption. Source: Bureau of Mines and Federal Power Commission.

Propane decarbonizing . . . The solvent-extraction process, employing butane as well as propane for recovering additional catalytic feed stock from reduced crude, shows considerable promise at the present time. Total capacity of five such operating units in this country has reached 63,000 bbl. per day. In addition, some propane deasphalting units employed for the production of heavy lubricating-oil stocks are designed to produce catalytic feed stocks on blocked-out operation.

Advanced development of this technique permits deep cuts into the residual fraction. Several new units are now in design stages, and the process is expected to receive added attention in the future.

Extraction of heavy cycle stocks . . . Heavy gas oil from catalytic cracking may in some cases be recycled to extinction, or may be withdrawn for disposal as heavy fuel. Recent developments in the use of furfural and sulfur dioxide to extract these stocks have a direct bearing on improved realization from these heavy fractions.

Solvent extraction results in the separation of aromatic and olefinic hydrocarbons plus a preponderance of sulfur, nitrogen, and oxygen compounds in the extract phase, from the essentially paraffinic hydrocarbons in the raffinate. The latter shows greatly improved characteristics as both diesel fuel and as catalytic feed stock. The extract fraction can be used as cutter stock for heavy fuels. It is finding an increasing demand for such specialty uses as wood preservatives, insecticides and herbicides, rubber plasticizers and softeners, and carbon black. By removing some of these fractions from the heavy-fuel catagory, these extraction processes are contributing directly to the greater dollar realization from the whole barrel of crude.

Future processes . . . Recent improvements in techniques for converting residual fractions to gas show promise of extending the processing horizon still further. Aimed at the production of gas for fuel or chemical uses, it is probable that these processes will be employed outside refineries. If commercially successful, they may well represent a long-term outlet for the residual fraction of many refiners.

One development which has successfully passed the pilot-plant stage is the Thermofor pyrolytic cracking process for high-B.t.u. fuel-gas manufacture. T.P.C. was originated by Socony-Vacuum Oil Co., Inc., in 1948[6] for production of light olefins and some aromatics from residuals. More recently, it has been adapted for fuel-gas synthesis[7] by Surface Combustion Corp. with Socony-Vacuum help.

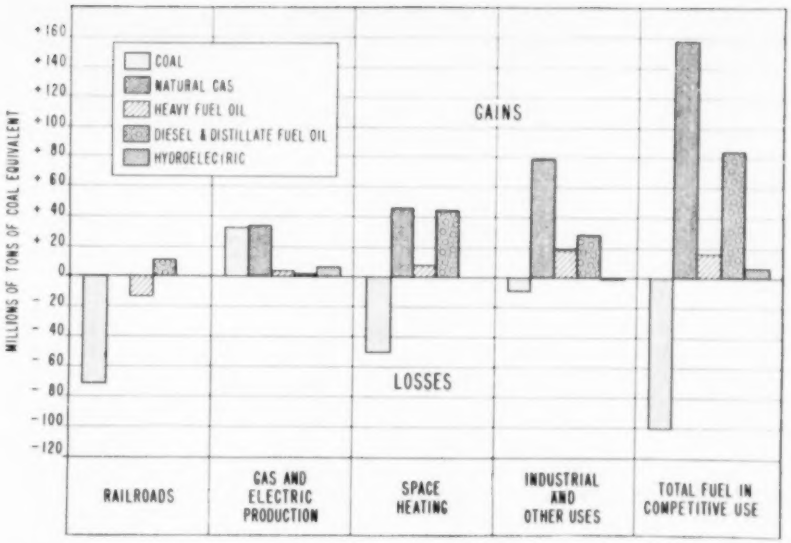


Fig. 4—Competitive gains and losses in United States fuel consumption 1952 vs. 1946. Source: Bureau of Mines and Federal Power Commission.

Mechanically, the process is similar to T.C.C., employing a moving bed of coke particles or pebbles through a heater, two reactors, and a drying zone. The heavy feed stock is thermally cracked at high severity by contact with the pebbles heated to 1,500°-1,600° F. Cracked products are immediately quenched and the heavy coke deposition resulting from the reaction is laid down on the pebbles.

Fuel gas of 950-1,050-B.t.u. per cubic foot quality is obtained at yields of about 84 cu. ft. per gallon of feed, and liquid and coke yields are respectively about 33 and 22 weight per cent of feed.

Developers of this process foresee its use not only for seasonal synthesis of makeup fuel gas, but also for the possible synthesis of ethylene and liquid aromatics for petrochemical purposes.

The fluid catalytic cracking process may also lend its mechanical features to the high-temperature thermal cracking of residuals. The Institute of Gas Technology[8] is conducting pilot-plant studies of fluid gasification of both distillate and residual feed stocks at thermal cracking temperatures as high as 1,700° F. The gasification reactions in the fluid process are the same thermal cracking reactions occurring in existing cyclic or tube furnace oil-gas generators. The fluid process affords better control of the carbon laydown and tar-handling problems.

Further work is under way to improve this technique for gasification of residual oils. Investigations of improved feed systems and product-recovery facilities are expected to pave the way for design of a commercial unit to operate continuously on a residual charge for production of high-B.t.u. oil gas of specific properties.

In a third development of current interest, Texaco Development Corp. is conducting pilot-plant investigations on conversion of residual petroleum fractions to synthesis gas for end use as petrochemicals. The work has not yet progressed to a point permitting publication of results, but it is regarded with interest by both the oil and chemical industries.

The Pattern for Demand

While domestic refineries will continue to reduce the output of residual fuels on the basis of crude run to stills, the expanding volume of refinery operations will probably result in some small increase in total production over the next several years. Domestic demand is expected to remain essentially static for the near future, and imports of residual fuels will continue to supply an important segment of the supply mainly along the Eastern Seaboard.

Demand will remain strongest in the East for several reasons. This marketing area is least affected by dieselization of railroads which has severely cut the demand in many inland markets. Although natural gas is now available in that section of the country, its cost after long-distance transmission is such that it is not expected to compete so strongly with heavy fuel as in the markets nearer to gas production. Forecasts of high levels for industrial activity and shipping will support demand in the East where these two factors dominate heavy-fuel consumption.

In the nation as a whole, the short-

range pattern will continue to follow present trends in the various end uses for heavy fuel, (Fig. 2). Long-range forecasts, such as those attempted by the Paley Commission[9], project total domestic demand for residuals at about 3,000,000 per day by 1975, which is double the demand of 1950. This corresponds to expected increases of 110 per cent in gasoline demand and 130 per cent in the demand for kerosine and distillate fuels.

Position of energy source . . . In the over-all energy picture, residual fuel oil has barely held its own since World War II. Figs. 3 and 4 show that while consumption on a B.t.u. basis increased modestly, heavy fuel oil's share of the total expanding consumption of fuels is off slightly. This static position compares with phenomenal consumption gains in natural gas and in distillate fuels including diesel fuels but excluding gasoline.

The sole loser in this postwar period was coal which suffered competition from all angles. It lost markets to natural gas as that preferred fuel became more readily available in the large energy-consuming areas of the nation. The swing to diesel power on railroads and in other power installations struck at coal markets as it did at heavy-fuel markets. Finally, as illustrated in East Coast price trends (Fig. 5), the ascending cost of coal with respect to residual fuel oil placed the latter in a relatively preferred position for industrial, utility, and space-heating consumers.

The increased supply of heavy fuel oil to the East Coast, bolstered by imports, is largely responsible for the maintenance of residual-fuel consumption in the over-all national picture. Postwar gains in supply and consumption, shown in Fig. 6, were largely offset by declining consumption elsewhere in the nation.

Prices . . . In the future, the relative position of heavy fuel and coal will depend mainly on price. Many major users are equipped to convert from one to the other in order to take advantage of price fluctuations. Price will also play an important part in the relative consumption of heavy fuel and natural gas, particularly in large market areas removed from gas production. When transported 1,000 or more miles, natural gas is generally considered to be no longer competitive with locally produced residual fuel for power and industrial purposes. This rule-of-thumb competitive limit for gas is subject to as much variation as the relative prices for the two fuels. The rising price of gas at the well head may further improve the position of residual fuels.

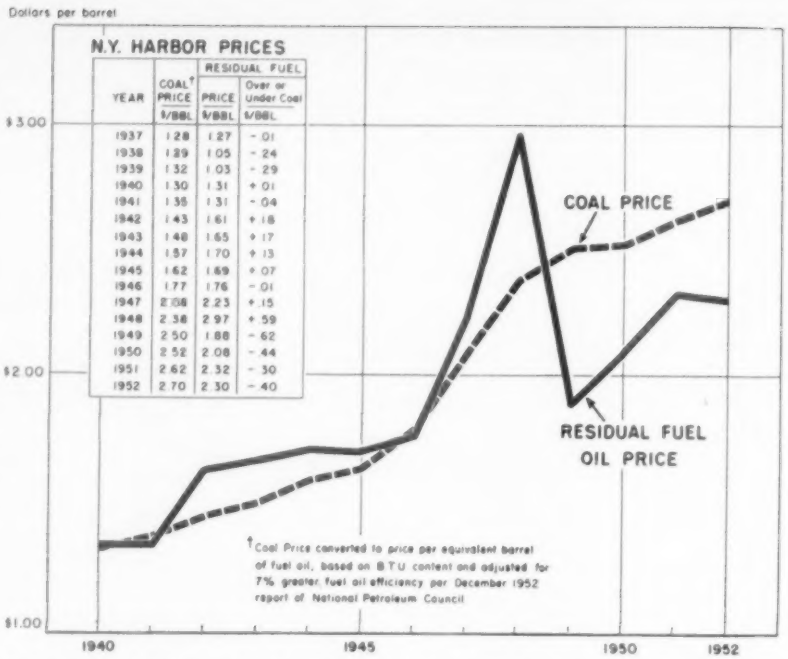

Dollars per barrel
N.Y. HARBOR PRICES
RESIDUAL FUEL
YEAR | COAL† PRICE $/BBL | PRICE $/BBL | Over or Under Coal $/BBL
1937 | 1.28 | 1.27 | - .01
1938 | 1.29 | 1.05 | - .24
1939 | 1.32 | 1.03 | - .29
1940 | 1.30 | 1.31 | + .01
1941 | 1.35 | 1.31 | - .04
1942 | 1.43 | 1.61 | + .18
1943 | 1.48 | 1.65 | + .17
1944 | 1.57 | 1.70 | + .13
1945 | 1.62 | 1.69 | + .07
1946 | 1.77 | 1.76 | - .01
1947 | 2.08 | 2.23 | + .15
1948 | 2.38 | 2.97 | + .59
1949 | 2.50 | 1.88 | - .62
1950 | 2.52 | 2.08 | - .44
1951 | 2.62 | 2.32 | - .30
1952 | 2.70 | 2.30 | - .40
$3.00
$2.00
$1.00
COAL PRICE
RESIDUAL FUEL OIL PRICE
†Coal Price converted to price per equivalent barrel of fuel oil, based on B.T.U. content and adjusted for 7% greater fuel oil efficiency per December 1952 report of National Petroleum Council
1940
1945
1950
1952

Fig. 5—Residual-fuel-oil and coal prices on the United States East Coast, 1940-1952. Source: Independent Petroleum Association of America.

Also, the boosting of winter delivery rates by means of underground storage near markets will tend to bring gas supply and demand into better balance and should curtail the seasonal inroads into heavy-fuels markets during warm weather.

End Uses

As depicted in Fig. 2, heavy fuel oil finds a wide variety of end uses in this country. On the whole, the demand picture looks bright.

Some of the more spectacular inroads into heavy-fuel markets are expected to modify in the near future. The dieselization of railroads, for example, is by now well advanced. Heavy-fuel consumption in this class has been reduced from a peak of 308,000 bbl. per day in 1945 to about 76,000 bbl. per day last year.

Hence the bulk of this market loss has already been felt and although substitution of the more efficient diesel locomotives for heavy-fuel-burning steam locomotives will continue, the effect will diminish volumewise.

The competition from natural gas for industrial fuel, power plants, and space heating in large buildings may also taper off in the future. Except in the Southwest and other areas where natural gas is relatively cheap, heavy fuel is expected to hold its own, so long as it is not priced out of the market.

For bunkering vessels, heavy fuel enjoys an established market relatively free from the threat of increased competition. The projection of vessel consumption, like that for industrial consumption, generally is based on the expectation of a sustained level of world trade and of economic activity in this country. Military usage is predicated on a continued peacetime defense program.

Most of the factors affecting residual oil demand comprise basic economic forces which lie beyond the influence of the refiner. The supply and even the price of residual fuels are subject to less control by the producer than are supply and price of other petroleum products.

There remain, however, a number of other factors which may affect future consumption of heavy fuels. These factors concern mainly advances in technology and know-how which may enhance the consumption of these by-products of refining. Through participation in research and technical service, the oil industry can to some extent influence future heavy-fuel markets. Numerous consumers currently considering the use of heavy fuel will welcome the cooperation of oil companies in making such fuels more adaptable to their needs.

Internal consumption . . . Some refiners who have seen their heavy-fuel market dwindle are improving their plant balance by burning more heavy fuel under stills and boilers. This trend is most pronounced in Rocky Mountain and Middle West refineries where local

heavy-fuel consumption has been hardest hit. As shown in Table 1, however, refineries along the Atlantic seaboard burn more oil per barrel of crude run than do those in any other section of the country.

For obvious reasons, refineries located in the Gulf Coast and the Southwest and Mid-Continent generally take advantage of low natural-gas prices. Since the outlook for future price increases is greater for gas than for heavy fuel, many plants now fueled mainly with natural and refinery gas will gradually convert to internal use of oil.

The 10-year trend in refinery fuels ending in 1952 does not yet reflect any increase in oil consumption. As shown in Fig. 7, oil now contributes fewer B.t.u.'s per barrel of crude run than in the early postwar period. Natural gas has made the greatest gains.

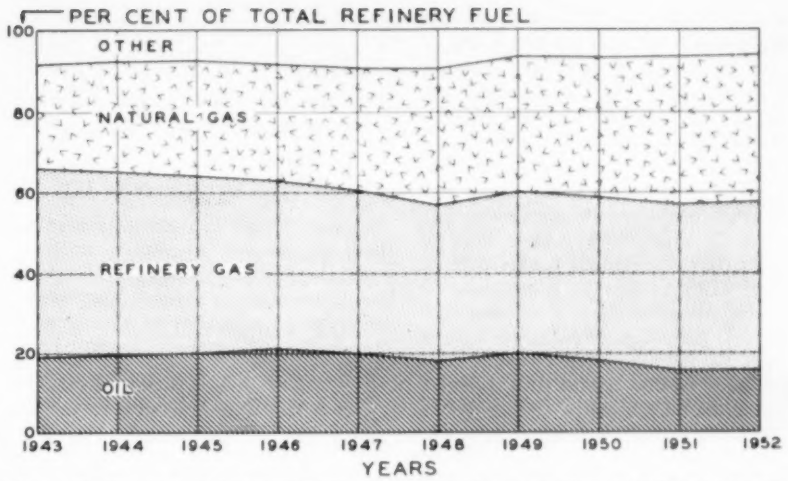


Fig. 7—Relative rank of various refinery fuels expressed in percentage of total B.t.u.'s consumed. "Other" fuels include acid sludge, coke, coal and steam. Source: U. S. Bureau of Mines.

High-viscosity fuels . . . Some refiners are going a step beyond the burning of conventional No. 6 fuel, and are burning hot high-viscosity residuals such as asphalt pitch and thermal tar. This step obviates the degradation of distillate cutter stocks for plant fuel, and reduces the net yield of heavy stocks requiring distillate blending before marketing.

Recent improvements in temperature control of hot fuel systems, and in the design of burners handling the high-viscosity fuel now make this practice more attractive to refiners. A system for burning thermal tar is reported on page 182 of this issue. Heavy vacuum pitch can also be fired directly to refinery steam boilers.[10]

The use of unblended high-viscosity residual fuels is not necessarily restricted to refinery use. In a number of instances, heavy pitch or tar-bottoms streams withdrawn directly from process units are delivered with limited or no fluxing to nearby steam-generating plants operated by utility companies. Three examples of this practice are found in Salt Lake City;[11] Billings, Mont.;[12] and Philadelphia.

External markets . . . On a national basis the market losses due to the postwar dieselization of railroads have been more than offset by consumption gains on the part of electric utilities, industry in general, and purchasers of fuel for space heating of large buildings. For example, during the first 11 months of 1952 and 1953, railroad purchases of residual fuel oil declined from 110,000 to 77,000 bbl. per day.[13] More than offsetting this 30 per cent decline were purchases from electric power plants which rose from 160,000 to 210,000 bbl. per day during the same two periods. This major shift in demand has favored the more concentrated industrial areas, particularly the Atlantic seaboard which lost the least in railroad markets and gained the most in the utility, industrial, and space-heating classes.

At comparable prices per B.t.u., heavy fuel oil is generally favored over coal by many utilities, industrial plants, office buildings, schools, hospitals, department stores, etc. It is preferred because of its ease of handling and storing, the elimination of ash, smoke reduction, and higher efficiency due to its better adaptability to automatic control.

This degree of acceptance is illustrated by a customer survey recently conducted by Esso Standard Oil Co.[14] The survey revealed that of the 3,287 nonmarine customers, 97 per cent representing 73 per cent of the total volume of Esso's heavy-fuel sales, were not equipped to switch to another type of fuel should heavy-fuel-oil supplies be cut off. Most of the consumers in a position to switch to another type of fuel were in the utility group.

Assuming this degreee of preference for heavy fuel oil over coal, it would appear that heavy fuel oil has a firm future demand so long as its price remains competitive. However, the situation is not as simple as that. Many consumers and engineering firms which design and construct their steam plants and furnaces are showing concern over the trend in heavy-fuel quality, and the attendant problems which may arise from deposits and corrosion.

As refiners dip ever deeper into the bottoms fraction to recover additional feed stocks for catalytic cracking, they gradually degrade the quality of the shrinking residual fraction to be marketed as heavy fuel. As the residual yield declines, the remaining product will show successively lower gravity, higher viscosity, carbon residue, sulfur content, and ash. It has been estimated that 15 or 20 years hence when the over-all residual yield in domestic refineries has declined to about 10 per cent of crude, that the remaining heavy-fuel product may show a carbon residue of 18 per cent, a pour point in the neighborhood of 50° F., sulfur con-

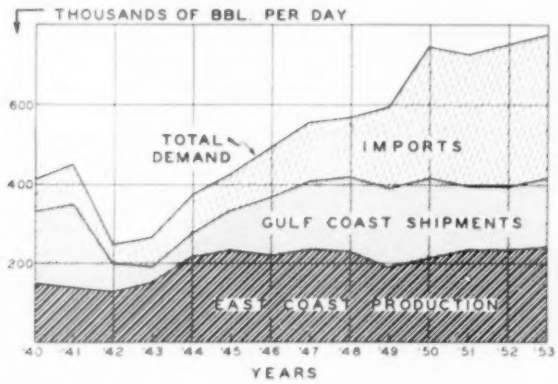


Fig. 6—The Eastern Seaboard enjoys the strongest demand for heavy fuel oil. Bonded imports for ships bunkers are included in total imports shown here. Included in Gulf Coast shipments are receipts from California of 18,000 bbl. per day and 42,000 bbl. per day in 1949 and 1950 respectively.

tent of approximately 5 per cent, and ash content approaching 0.5 per cent.

What particularly worries these consumers is the effect of the rising sulfur and ash content on tube deposits, tail-end corrosion due to sulfur, and high-temperature corrosion due to vanadium. It is reasonable to expect that remedial measures now under way, primarily in the additive field, will at least offset this gradual quality deterioration in heavy fuels of the future. On the side of caution, however, some contractors presently recommend against heavy fuel in power plants and specify maximum sulfur content for fuels to be used in heating units.

For example, one major engineering firm in the heating and power field will not specify less than No. 5 fuel oil or No. 6 fuel with more than 1 per cent of sulfur for boiler units operating under 15 psi. because of the low-temperature corrosion problems involved when using poorer-quality fuels. Less than 1 per cent sulfur is specified for fuels to be used in systems with end temperatures of 240° F. and in systems with high end temperatures of 350° F. the maximum sulfur allowable in fuel is 3½ per cent.

In the high-temperature, high-pressure steam systems which are gaining preference in central power plants, limits are placed on the use of heavy fuel oil because of vanadium content. Opinions differ as to the temperature limit at which residual fuel oil can safely be used. It is generally agreed, however, that vanadium-bearing ash becomes highly corrosive at temperatures above the melting point of the ash. Laboratory studies on gas turbines indicate that this attack is not likely to be serious at temperatures below 1,200° F.

The temperatures cited are metal-surface temperatures. If sufficiently high, they permit the ash to melt in direct contact with the metal. The presence of vanadium pentoxide in the ash destroys the protective oxidized metal coating and causes a severe "wormhole" type of corrosion. None of the commercially available alloys is immune to this type of attack when a vanadium-containing ash contacts metal in a molten state.

Heavy-fuel-oil prices, largely affected by the price of competitive coal, give forecasters a headache. When they look into their crystal balls, all they seem to see is a pair of heavy black eyebrows.

As a result of these findings, some designers of high-temperature steam plants will not specify heavy fuel oils if top metal tube temperatures of 1,300° F. are to be reached, while others are more stringent in their requirements. Actually, there appears to be no temperature threshold below which heavy fuels are safe and above which they are not. Corrosion due to vanadium pentoxide varies with the concentration of vanadium in the ash, and with the presence of other ash components, particularly sodium. A decision against the use of heavy oil may depend on the degree of corrosion tolerance the operator is willing to assume in relation to other factors favoring oil over coal.

In general, utility companies are accustomed to much longer amortization periods for equipment than are refiners. As a result, they might consider as completely intolerable, a corrosion rate readily accepted by refiners. A point which might tip the scales toward fuel oil is the value of the deposits removed from boiler tubes. One New England power company has found that this deposit has a very high vanadium content and brings a good price. While this may be a minor factor if the use of heavy fuel oil threatens the possibility of serious corrosion, on the other hand it is a point to consider in an even choice between coal and oil.

More research needed . . . The intensive research effort being conducted in the gas-turbine field is contributing much new information which the oil industry may adapt to better the utilization of heavy fuel for the higher-temperature steam generation to which utilities are moving generally. However, much of this new light being shed on the dual deposit-corrosion problem in gas-turbine operation still lacks precise interpretation for application of heavy fuels to the relatively less severe conditions involved in boiler and furnace operation.

It is believed in some circles that the limitations of heavy fuels in gas-turbine use may tend to be applied too arbitrarily to the less-severe conditions involved in high-temperature steam generation. Actually, although random No. 6 and Bunker C fuels are not yet acceptable in gas turbines, they are finding regular use by many utility companies without posing serious maintenance problems.

Utility companies and designers of their facilities are conducting some

TABLE I—FUEL CONSUMED AT REFINERIES IN THE UNITED STATES, 1952, BY DISTRICTS

District—	Oil, thousands of bbl.	Acid sludge, thousands of bbl.	Coal, thous. short tons	Gas, millions of cu. ft.		Coke, thous. short tons	Purchased elec., thousands kw.-hr.	Total B.t.u., billions (approx.)	Crude runs to stills, thousands of bbl.	B.t.u. per bbl. of crude run
				Natural	Refinery					
East Coast	17,018	347		12,201	53,445	299	631,465	202,588	376,769	538,000
Appalachian	1,232	37	502	2,500	12,932	45	214,490	44,116	66,880	660,000
Indiana, Illinois, Kentucky, etc.	11,161	465	264	14,558	93,410	434	723,285	242,177	449,171	539,000
Oklahoma, Kansas, Missouri, etc.	2,811	318		47,272	33,257	48	440,318	118,702	199,141	596,000
Texas Inland	154	1		39,853	18,708		261,028	70,806	93,888	754,000
Texas Gulf Coast	56	1,919		228,464	103,607	289	392,754	416,536	585,258	712,000
Louisiana Gulf Coast	17	199		95,299	25,431	239	407,253	146,405	191,072	766,000
Arkansas, Louisiana Inland, etc.	106	28		12,055	3,039		37,184	17,957	29,122	617,000
Rocky Mountain	2,846	119		8,504	14,926	112	151,070	51,752	88,030	588,000
California	4,617	166		75,696	67,080		991,961	216,110	361,928	597,000
Total U.S.A.	40,018	3,599	766	536,402	425,835	1,466	4,250,808	1,527,149	2,441,259	626,000
Total B.t.u. (billions approx.)	232,104	16,196	19,916	563,222	638,753	*56,958		1,527,149		

*Includes purchased steam.

On the subject of "cheap" residual fuel for gas turbines, recent panel discussions have developed more heat than light. Metallurgists admit to no pat solution for deposit and vanadium corrosion problems, but fuel additives look good. Until the two-headed specter is dispelled, heavy fuels used in gas turbines will continue to comprise experimental tailored grades and hence not "cheap" fuels.

work on more successful use of heavy fuels. These groups would welcome a better organized research effort on the part of the oil industry, directed toward studies of the effects of contaminating elements and the evaluation of various additives in neutralizing these elements. The refiner, on the other hand, is likely to question the returns which might result from any extensive research program directed toward a by-product which he is attempting to minimize.

In the light of present knowledge it appears that the reprocessing of heavy fuels to reduce or eliminate sulfur, vanadium, and other deleterious elements is out of the question. Even if processes for extraction or conversion and subsequent removal of these contaminants were commercially feasible today, they would raise the cost of such fuels. This would automatically remove the treated product from much of the market by making it too expensive to compete with alternate fuels.

The most promising approach to the problem today appears to be through the use of additives. However, such additives must be low in cost to prove practical.

Deposits . . . A number of additives are proving successful in combating the problem of heavy-fuel ash deposition on heater and boiler tubes. Dolomitic lime appears to be one of the best.[15] Other additives such as straight magnesium oxide and materials containing variable contents of that compound are being studied.

This type of additive is a drying agent which converts stickly oil-slag tube deposits to a powdery form which is more easily removed from tubes by soot blowers, lancing, or caustic washing. A report of this type of additive application in three refinery steam boilers operated by the Sinclair Refining Co. appears in this issue.

In some cases the additive is blended with the fuel directly ahead of the burners. In others, where deposition causes plugging of air preheaters, dolomite and fly ash are introduced to the gas stream behind the superheater section and just ahead of the preheater.

The use of dolomite additive has proved economical in space heating and other low-temperature installations where No. 5 fuel has been used in place of No. 6 to avoid deposit problems. For example, assuming a boiler operating at 12,000 lb. of steam per hour and 15 psi., is used for 8,000 hours per year. No. 5 fuel would cost an estimated $10,000 more per year than No. 6 fuel. The conversion to No. 6 fuel oil plus additive can be made for about $1,000, the cost of installing an additive system. This first cost, plus an annual cost of $140 per year for dolomite at $12 per ton, represents a sizable saving.

The deposit problem is also being successfully combated by design modification. Most boiler manufacturers have come to recognize the need for wider spacing of air preheater tubes for example, and are now designing equipment which operates successfully with heavy fuel oil.

As a result, the difficulties encountered with tube deposits when using fuel oil would seem to be well on the way to solution. Further investigations

may develop new additives which can control deposition at lower cost. As this field of study progresses it is hoped that some additive price stabilization may result, particularly if a mass market develops for a particular type. In some instances, the price of an additive jumped when the supplier learned that it was proving successful in this application. A little more competition, incited by wider demand, would contribute toward a quicker solution to the over-all problem of additives in heavy fuel oil.

Corrosion . . . The corrosive effects of rising sulfur and ash contents in heavy fuel oils are a matter of greater concern to many power-plant operators and designers. They foresee the possibility that residual-fuel quality in these respects will continue to deteriorate as refinery yields decline. In the probability of higher future use of imported crudes they see still further increases in the content of sulfur and vanadium compounds in heavy fuel oil.

Again, it appears entirely impractical to attempt to reduce or eliminate these corrosive elements by further processing of residual stocks. Crude desalting at refineries has some beneficial effect in reducing the sodium content of residual fuels. Washing with fresh or salt water has also shown some improvement in removing corrosive sodium from heavy fuel oil, although difficulties are encountered in centrifugal separation when the gravity of the fuel approaches that of water. But even such forms of treating heavy fuel must necessarily increase its cost. So the additive route seems the most likely, although additives have not yet proved as successful as in the control of the tube deposit problem.

The low-temperature corrosion resulting from the presence of sulfur compounds in the fuel may be relieved to some extent by the use of dolomite which is added mainly for deposit control. Although this effect is at present considered inconclusive, it is believed that dolomite may prove economic in neutralizing the "tail end" corrosion occurring near the discharge end of power-plant systems.

In one instance, dolomite introduced to alleviate a deposit problem has shown an added dividend in correcting an air-pollution problem. By combining with corrosive products in the stack, this additive is reported to have neutralized them to some extent and also lightened them so that they were better dispersed in the atmosphere. It was implied that tail-end corrosion at least in the stack was thus reduced. Power-plant operators and designers agree that other additives may prove equally effective in combating low-temperature sulfuric acid corrosion, and they seem to expect the oil industry to initiate or at least participate in the study of such corrective measures.

Vanadium corrosion . . . The very severe corrosive action of vanadium pentoxide at high temperature may be causing undue alarm in the utilities field. It is true that vanadium corrosion has to date given much trouble in gas-turbine operation, and in some instances, severe corrosion of tube hangers and tubes has occurred in boilers and furnaces.

However, a number of utility companies along the Atlantic seaboard are using great quantities of heavy fuels of relatively high sulfur and vanadium contents without encountering serious trouble. One large company consumes

about 20,000 bbl. per day of a cutback heavy residuum which contains higher ash and sulfur than the average No. 6 oil marketed in the East.

This particular company is using coal to fire its newest steam units in which tube surface temperatures close to 1,300° F. are encountered in producing 1,100° F. steam. These units used the heavy fuel oil as backup fuel for about 3 months last year without showing any evidence of tube corrosion due to vanadium. It is interesting to note that the rising price of coal has forced this company, among others, to resort to poorer grades which have sulfur contents equal to, or higher than, the fuel oils they burn.

Given the choice between a coal and a fuel oil with equal sulfur content, however, utilities would tend to favor coal, because the sulfur compounds found in heavy oil tend to cause more trouble. This is but one of the factors which big utilities take into consideration in judging the fuels they will use.

The choice of fuel to buy is a matter of continuous decision on the part of many large utilities which can freely convert either way with a large percentage of their capacity. It is a much more complex matter than simply comparing cost on a straight B.t.u. basis. The higher hydrogen content of oil on the average results in a 2 to 3 per cent greater water loss to the stack, which loss must be debited against oil.

In units originally designed for burning coal, the deposit problem arises when converting to oil, particularly in air preheaters. Additives can offset much of this trouble provided units are equipped with soot blowers. When not so equipped, operators must resort to periodic caustic washing at an increase in maintenance costs and some loss in capacity.

Another factor working against the wider use of oil is the cost of storage. This is particularly effective in large metropolitan areas where utilities are restricted in the volume of liquid stocks they can store. Since they must maintain uninterrupted service they tend to rely more on coal because they maintain heavier stocks against the eventualities of strikes, spot shortages, etc.

Variable specifications, particularly regarding sulfur, rule against the use of oil in some cases. Some large metropolitan utilities purchase oil ranging primarily from 2½ to 3 per cent sulfur. However, some lots may run over 4 per cent. It is not practical to test each lot and adjust operations accordingly, hence utilities must elevate exit-gas temperatures as much as 100° F. to avoid tail-end corrosion when using oil. This loss in efficiency is charged against the use of oil.

Many utilities in large industrial areas served by natural gas will burn this fuel in large volumes during the summer months. The low maintenance costs attending use of this fuel make it much preferred to coal or oil when available at a reasonable price. The growth in underground storage, however, may reduce future utility consumption of gas in areas distant from the Southwest, by diverting much of the summer supply now available at low rates.

A consensus of utilities regarding choice of fuel can be summarized by stating that they burn on economy. All cost factors—fuel price, storage, preparation, corrosion damage, and maintenance—are weighed in the day-to-day decision for or against oil. Hence the future demand from this class of users can fluctuate widely, being sensitive to relative prices, level of industrial activity, weather, strikes, and numerous other factors difficult to predict.

For the present it does not appear that vanadium corrosion is seriously affecting the heavy-fuel market in the field of steam generation. It may enter the picture, however, as the trend progresses toward higher steam temperatures in large central-power installations. Corrosion is known to increase strongly with temperatures above the melting point of deposits containing vanadium pentoxide.

A rising vanadium content in heavy fuels may also hasten the day when some corrective measures will be necessary to maintain demand from this class of consumers.

Against that eventuality, the oil industry may investigate the application of some findings in gas-turbine research. British studies conducted with miniature combustion chambers subjecting alloy samples to vanadium-containing ash at 1,472° F. have indicated that some alloys such as 18-8 Cr-Ni and 20-80 Cr-Ni showed best resistance to attack, with alloys of intermediate Cr-Ni ratios being about twice to four times less resistant.[16] These tests also confirmed that sodium could be just as corrosive as vanadium, and unfortunately, some of the alloys most resistant in the presence of vanadium were attacked more severely than others by the sodium. These findings, which bear out current admissions by metallurgists that they have no solution to gas-turbine corrosion, tend to rule out the possibility of resorting to corrosion-resistant alloys in high-temperature steam generation.

Attention turns again to additives. Some investigators[16] report that while no complete solution has been found, the more successful materials have proved to be calcium, magnesium, zinc, and phosphorus, introduced into the fuel in oil-soluble form such as naphthenates, stearates, or in the case of phosphorus, as an aqueous solution of phosphoric acid or as tricresyl phosphate. Of these additive elements, calcium is more or less ruled out for gas-turbine use because of the increased ash deposition incurred because of the large quantities required, although this may not rule against calcium in boiler use.

Another group of British investigators, reporting on vanadium corrosion in gas turbines,[17] verify the relative resistance of nickel-chromium alloys with respect to austenitic steels, adding that those containing molybdenum show the least resistance. None of the commercially available metals or alloys is immune from attack, they find.

As to additives, this research team concludes that dilution of the ash by the addition of magnesium oxide, zinc oxide, aluminum oxide, kieselguhr (diatomaceous earth), or vermiculite resulted in a considerable reduction in the rate of corrosion. They warned, however, that under laboratory conditions all of these additives except magnesium oxide brought about a marked increase in attack when present in certain critical proportions. Investigation of the action of these additives, particularly low-cost kieselguhr in high-temperature steam generators, may lead to some alleviation of a potential corrosion problem.

Still other promising additives have been tested by the Swiss.[15] They report the formation of combustion products of fuel oil which destroy the protective

Heavy catalytic cycle stocks seem to be emerging from the ugly-duckling class. Solvent extraction makes a high-grade raffinate for cat feed stock and even the extract phase is gaining the interest of chemical, rubber, and carbon-black makers and wood preservers.

Vanadium corrosion may be losing some of its scare for heavy-fuel consumers. Several utilities, admittedly a finicky group, have found vanadium fuels tolerable in high-temperature steam generation.

oxide film on high-temperature alloys may be partly inhibited by the addition of inorganic chlorides to the fuel. Volatile halides are formed which do not attack the metal. Thus, fuel oil containing 0.2 per cent V_2O_5 requires the addition of 5 g. of NaCl, $CaCl_2$, or $(NH_4)2\text{-}SnCl_6$ per kg. of fuel oil. They also report that the addition of 5 g. of Al_2O_3 per kg. of fuel oil counteracts the harmful effects of 0.2 per cent of Va_2O_5 in the oil. They suggest other additives, such as ZnO, diatomaceous earth, SiC, CaC_2, $BaCO_3$, $FeCO_3$, aluminum acetate, and powdered iron, aluminum, silicon, or ferrosilicon.

In anticipating marketing problems, refiners should bear in mind that the utility industry is much less tolerant when it comes to corrosion rates. Hence a heavy fuel which a refiner may consider acceptable for internal use at high temperatures can be ruled out by a utility company which operates on a longer amortization period. Relatively few cases have been reported of severe vanadium corrosion which brought about short-term failure of tubes or other internal metal members in boilers or furnaces.

The loss of fuel-oil markets due to this factor may well occur when a customer finds that his corrosion rate has exceeded a certain level. Remedial steps through the use of additives should be considered on the basis of their ability to alleviate the corrosion rate and not necessarily to eliminate it altogether.

Gas turbines . . . Much has been written of the great potential application of the gas turbine. When referring to its operation of heavy residual fuel oil, most predictions are based on the availability of "cheap residual fuel oil." Moreover, this cheap fuel is assumed to be available everywhere in a digestible form.

Unfortunately, a residual fuel to remain cheap must be taken as is. Unlike the standardized distillate products of petroleum, residual fuels vary widely in specifications.

Despite these basic limitations to widespread adoption of gas turbines using cheap residual fuels, some progress is being made. A good example of domestic developments is the service experience accumulated by 13 residual fuel-burning gas turbines manufactured by General Electric Co. Ten of these are locomotive units which had seen over 50,000 hours of service before the end of 1953, and the remaining three were power-generation units with about 7,000 hours of total operation.

The service experience gained from these and other commercial gas-turbine units in this country has focused on two existing problems: corrosion of metallic parts by vanadium pentoxide and sodium sulfate, and ash deposition on nozzles and buckets causing losses in efficiency and capacity.

At the present stage of development, residual fuel must meet certain specifications to be usable in gas turbines. The latest revision of these specifications is as follows:

"1. **Viscosity:** The viscosity should be such that the oil can be heated to such a value that it will have 95 S.S.u. or less at the fuel nozzles. The fuel can be heated to any temperature up to a maximum of 250° F. at the fuel pump to get the viscosity of 95 S.S.u. and provided the temperature satisfies the stability limit defined in Item 3.

"2. **Character of ash:** (a) The ratio of the weight of sodium in the ash to the weight of vanadium in the ash should not be greater than 0.3. If this ratio is not satisfied by the original oil it can be obtained by removing sodium by means of washing, centrifuging, filtering, electrostatic precipitating, or by any other desalting means.

"(b) The ratio of the weight of magnesium to the weight of vanadium in the ash should not be less than 3.0. Oil-soluble materials can be added to the fuel to obtain this ratio, in case it does not satisfy the condition naturally. In cases where the oil is modified at the point of use, water solutions of suitable magnesium salts, such as magnesium nitrate or magnesium sulfate, may also be added to obtain the desired ratio but they must be thoroughly mixed with the fuel to obtain a fine and uniform dispersion, and the oil must be burned sufficiently soon after treatment to avoid partial separation, or settling out, of the water solution.

"When the vanadium content is 2 p.p.m. or less, the foregoing weight ratio of magnesium to vanadium need not be maintained.

"(c) The sodium content of the oil should not exceed 10 p.p.m. and a value of 5 or less is preferred. When the sodium content is 5 p.p.m. or less, the foregoing weight ratio of sodium to vanadium need not be maintained.

"(d) The calcium content should not exceed 10 p.p.m. and a value of 5 or less is preferred.

"(e) After Items 2 (a), (b), (c) and (d) are satisfied, the total ash content in the oil should not exceed 2,000 p.p.m.

"3. **Stability:** The oil should be sufficiently stable to show a No. 2 tube or better in the Naval Boiler Testing Laboratory heater test. (Military specification for fuel oil MIL-F-859 dated January 20, 1950. Also Federal Standard Stock Catalog IV, Part 5, method 346.1). If the oil requires heat in excess of 210° F. to obtain the necessary spraying viscosity it should be more stable and show a No. 1 tube or better by the foregoing test.

"4. **Compatibility.** The oil shall show a No. 2 tube or better in the N.B.T.L. heater test with other oils that are to be used to supply the unit with fuel.

"5. Bottom solids and water shall not exceed 2 per cent. (A.S.T.M., D-396-48T).

"6. The sulfur content should not exceed 3½ per cent."

Refiners will recognize that these specifications cannot be met by many residual fuels now being marketed in this country. In order to meet these requirements much of the current production would need to be elevated to the catagory of a tailored fuel, which automatically takes it out of the "cheap" class. Hence the gas turbine does not yet represent an important consumer of heavy fuel oil.

Solution on the Way?

The intensive research efforts here and in Europe have reversed the original pessimistic feeling that gas tur-

(Continued on page 154)

This year may bring to light a cheap additive which will make heavy residual fuels completely digestible in gas turbines and high-temperature steam plants. This would widen demand, but would probably not improve the price situation to much extent.

The New Jersey Turnpike, a 118-mile superhighway, connects the George Washington Bridge west of Manhattan, with the Delaware River Bridge to Wilmington, Del. It was built of asphalt at a saving of $5,500,000 under the alternate bid for rigid pavement. (Photo courtesy of Asphalt Institute Quarterly.)

2. ASPHALT . . .

Here is what might be called a depressionproof product. Demand, strong in good times, probably will be stronger in a recession because of the increase in road building and water reclamation.

by George Weber
Refining Editor

THE demand for asphalt, particularly for road building, looks bright over the extended future. Today, asphalt is manufactured in a total of 116 refineries in this country, which have a total capacity for producing about 320,000 bbl. per day of this residual product. Road paving represents the greatest single end use for asphalt, consuming about 75 per cent of all current production. Since highway projects are limited in many parts of the country to the warmer summer months, asphalt is subject to a wide seasonal fluctuation in demand. As a result, refiners operate asphalt facilities at less than 80 per cent of full capacity over the year, diverting residual fractions to heavy fuel oil and other end uses during much of the winter.

In 1953, all records were broken for the production and consumption of asphalt. Based on operations during 11 months of the year, total asphalt production reached nearly 73,000,000 bbl. last year, a 3.8 per cent increase over 1952 and an increase of 62.5 per cent over the output of 1946.

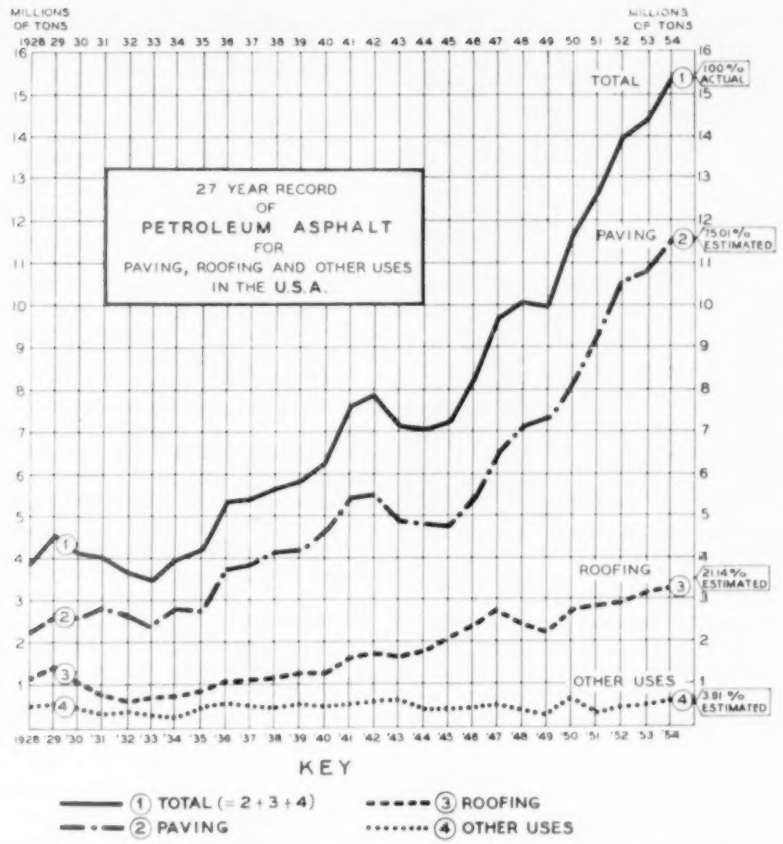
Road-oil production was off about 400,000 bbl. last year from the 1952 record output of nearly 7,000,000 bbl. but the total volume of residuals going into asphalt and road-oil end uses showed a net increase, to total about 79,500,000 bbl. or about 14,365,000 short tons for the year.

1954 outlook . . . The outlook for this year is for continued increases in nearly all end uses for asphalts. The percentage going into the paving of roads, airports, etc., should increase. During the past few years asphalt has gained over cement in total paving demand, and the trend is expected to continue.

Roofing asphalt demand will depend largely on the continuation of the nation's building program, which indicates that about 20 per cent of total production will go into that class of end use. Asphalt is finding numerous other uses, such as coatings, flooring, etc. These end uses are so varied and so competitive that experts hesitate to plot any far-distant trends. Since the uses other than paving and roofing absorb only about 3 to 5 per cent of total asphalt production, variations in these markets will have little effect on the total demand for asphalt.

Paving uses . . . Forecasts of actual demand for paving asphalts and road oils are extremely difficult. A growing need for highway building and repair exists, but the actual volume of construction and repair projects is too dependent on the allocation of government funds to permit accurate projection.

The United States has failed to keep pace with its highway requirements since before World War II, and the need for the building of new highways, the rehabilitation of existing ones,



Consumption of asphalt and road oils for all uses rose to a new record high of over 14,350,000 short tons in 1953. The prospect is for a steadily increasing demand for the long range future. Source: Bureau of Mines and U. S. Department of Commerce.

and the improvement of unsurfaced secondary roads has become greater each year. About 38 per cent of public roads of all types in this country are nonsurfaced. The rapid postwar increases in highway traffic, particularly on the part of heavy trucks, has resulted in a record rate of deterioration of all roads, and the needs for rehabilitation and widening of existing surfaced roads represent a sizable additional demand for asphalt products.

Highway builders expect construction and repair activity to show a continued upward trend in the future, regardless of the level of the nation's business activity. Actually, if the signs point to a business recession, the diversion of government funds to public-works projects might result in a marked increase in highway programs with an attendant rise in asphalt demand. Come good times or bad, the market for asphalt seems likely to continue at least moderately upward.

New techniques . . . Augmenting the basic firmness of future asphalt demand are a number of new technical developments which point to an increase in consumption over the next decade. These new techniques concern soil stabilization, overlay, construction of water reservoirs and irrigation systems, and stabilization of roadbeds by railroads. Research work is being stepped up on many of these potential applications. At the present stage of some projects it appears that cracked asphalts which presently find little demand for paving uses may actually be preferred for some specific uses.

Soil stabilization . . . The depletion of first-grade resources of aggregate in many sections of the country and their total absence in some states has resulted in a growing interest in the use of asphalt for soil stabilization. While this practice is presently followed only in certain geographical areas, improved techniques now being developed may bring about general application through much of the country.

The use of asphalt-stabilized soil for the base course of highways has become established practice in Florida, and is finding increased application in Kansas, Oklahoma, Missouri, and other midwestern states. A recent technical bulletin[1] published by the American Road Builders' Association states: "Soil-asphalt mixtures consist of combinations of soil, soil-aggregate, sand, or sand plus mineral admixture, with liquid asphalts, that are mixed and laid at ordinary temperatures, to provide base courses that will, when covered with a suitable wearing course, carry the applied wheel loads under all normal conditions of field moisture and traffic."

Numerous techniques have been developed from several years of experience for the successful use of native soils and asphalt for highway foundations. Although the spread of this practice may be gradual, it is regarded as an important potential outlet for millions of tons of asphalt.

Envelope technique . . . A new development in soil stabilization, called the envelope method, promises to extend the application of this practice to areas with clay-type soils. This type of soil stabilization is accomplished by sealing unmixed soil in an asphalt envelope, as contrasted with the established method of mixing soil with asphalt in a compacted bed. If moisture can be controlled in silty clay soils, they will support heavy highway traffic as well as aggregate base courses.

The procedure calls for trenching the right-of-way to a desired depth, and coating the sides of the trench with asphalt. The soil is then replaced and oversealed with an asphalt coating, after which a suitable paving course is laid.

A test recently conducted at Vicksburg, Miss., showed that silty clay thus sealed in asphalt maintained high strength, comparable to a crushed limestone base. A wide trench was dug and sprayed with 100 to 120-penetration asphalt. Cross-sections of the trench were then filled with crushed limestone, sand, a sand-clay-gravel mix and the original soil which was of a silty clay nature. The beds were then sealed over with asphalt and the finished paving was marked into three linear traffic lanes, each of which passed over all of the various base courses.

One lane was subjected to 60,000-lb. dual wheel loads representing 100-psi. tire pressures, the second to 90,000 lb. and 170 psi., and the third to 120,000 lb., 240 psi. Continual traffic over a long period showed that the native soil stood up as well as the crushed limestone, better than the sand, and somewhat better than the sand-clay-gravel base.

One problem remains in this envelope technique. While the Vicksburg tests proved its worth under heavy traffic loads over a limited period, studies are continuing to determine what grade of asphalt will best provide a permanent seal to prevent moisture from en-

Another superhighway built with asphalt is the Turner Turnpike connecting Tulsa with Oklahoma City. This four-lane divided highway paved with high-quality, hot-mix asphaltic concrete represents the more spectacular phase of current highway building.

tering the soil base for the expected life of the road.

While this technique is expected to prove less costly than the intimate mixing of soil and asphalt used in other soil-stabilization practices, it will require more asphalt. Roughly 2 gal. per sq. yd. are sprayed on the top, bottom, and sides of the sealed soil base. This would require roughly 1,300 bbl. of asphalt per mile, for a 24-ft. pavement.

Research under way . . . The Asphalt Institute is expanding its research effort to improve the techniques in applying asphalt and road oils to the nation's highways. A new research center to be located at University of Maryland will study soil stabilization and other practices.

In practice, cracked asphalts have in many instances proved superior to straightrun asphalts in soil stabilization. This results from their better affinity for certain types of soil, which permits a more effective coating of the soil particles. Further research may also disprove the value of the spot test which indicates the presence of cracked fractions in asphalt.

Many state highway commissions have adopted the spot test, ruling out cracked asphalts altogether, although the test is not considered a valid measure of asphalt quality. Many highways with cracked asphalt bases and straightrun asphalt surfaces are giving good service today. Further investigations in cooperation with state highway officials should develop improved standards, which may open new markets for cracked asphalts where few exist today.

Highway repairs . . . The extensive damage done to existing paved highways since the war has greatly increased the need for highway rehabilitation throughout the country. Much of the repair work consists of applying an overlay to existing pavements. Here again, asphalt is proving to be the preferred material.

In actual practice it has been found that a 4-in. asphaltic overlay will increase the strength of a 6-in. portland cement concrete pavement from a wheel load capacity of 9,000 lb. to 27,000 lb.[2] Extensive tests on strengthening of airfield pavements with asphaltic overlays indicate that wornout highways can be restored to their original strength, or strengthened over the original design, by the addition of asphaltic overlays.

Railroad stabilization . . . A number of railroads are becoming interested in the possible use of asphalt for roadbed stabilization as a result of a 10-year test conducted by the Illinois Central. A test section comprising ½ mile of single track was selected on the four-track main line near Manteo, Ill., south of Chicago. In 1943, the section of track was leveled, bad ties replaced, and an 85-100-penetration grade of asphalt was applied on the ballast and ties, extending to the ditch on either side.

The top of the rail was protected with skids placed beneath the spray bars of a distributor mounted on a flat car, but all the remaining surface including tie plates, spikes, ties, and ballast even beneath the rails was sprayed. Stone chips were applied over the entire surface followed by a light asphalt application and a covering of fine stone and sand.

For the first 8 years, the asphalt test section required 826.8 man-hours of maintenance labor per mile as compared with 1,207.6 man-hours for untreated track in the same division. Average annual tie renewal was 49.25 ties per mile for the treated section, vs. 117.5 ties per mile for adjacent trackage. In summary the railroad estimated that in 8 years it saved over $4,500 per mile in track maintenance labor and over $1,600 per mile in ties at the cost of $2,000 per mile for the asphalt ballast covering.

The road is now considering extension of the asphalt application to a 6 to 10-mile section incorporating certain changes as indicated by the results of the current test. The results of this initial test, which will be reported formally this coming summer, may open a sizable new market for asphalt.

On the basis of tests to date, the asphalt stabilization of railroad ballast would require about 3 gal. of asphalt per square yard, or 10,600 gal. per mile of track. Assuming a 10-year life expectancy, a continuing market for roughly 1,000 gal. per mile would result from application of this economic practice by railroads.

Hydraulic uses . . . A small but growing demand for asphalt comes from the government agencies and private utilities engaged in impounding and transporting water. The Bureau of Reclamation is conducting tests, using asphalt faces on rock fill and earthen dams, to determine the proper methods of application and the optimum thickness of asphalt required for erosion resistance and impermeability. Hot spray asphalt is finding increased use in lining irrigation canals and reservoirs in many areas.

As the demand for water increases in many western states, added attention will be devoted to means for controlling water seepage which in many cases results in losses up to 50 per cent. Numerous tests of hot spray asphalt and prefabricated membranes, many containing asphalt, are now under way to control water losses which are fast becoming intolerable.

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3. PETROLEUM COKE . . .

This product has been dubbed the squeal of the petroleum pig. This squeal is now a vital ingredient in manufacturing pig aluminum.

by George Weber
Refining Editor

LIKE other residual products, petroleum coke has long been considered a byproduct by the refining industry. The refiner's relative disregard of this product is illustrated by the fact that some companies in evaluating the economics of coking vs. other processes for augmenting distillate yields, have conservatively considered the value of the byproduct coke as zero.

The low prices obtained for many grades of coke high in sulfur and ash content tend to bear out this conservative estimate of petroleum coke's value. However, the unusual end uses for this product and their current demand trends indicate that the refiner might profit from a closer look at his coke market.

In the past, much of the petroleum coke produced in this country has been used as fuel. In this respect it has preferred qualities over other solid fuels and still commands a fairly good market in some geographical areas. What is new and interesting about coke, however, is the increased nonfuel use which it is finding. Moreover, these new uses appear to be growing, and it appears that petroleum coke may prove to be an important source of industrial carbon in the years to come.

The growing demand for coke on the basis of its carbon content is firm. For such uses as electrodes used in the aluminum and other metal industries, it competes with no alternate source. This is fortunate, since the outlook is for greatly expanded production of petroleum coke in the next few years.

Table 1 lists the current coking capacity in this country and the coking units of various type which are either contracted or definitely planned. Current capacity in United States refineries will handle a total of about 295,000 bbl. per day of reduced crude, to produce an estimated 8,850 tons of coke.

Construction program . . . Now under construction and slated for completion this year are six additional coking units totaling 30,400 bbl. per day capacity. Three large units now firmly planned will add 50,000 bbl. per day in 1955. The table lists only those new facilities which have been announced to date. A number of other coking units now in the planning stages will probably be on stream before the end of 1955.

Coking capacity alone cannot be used to indicate actual production of coke. Unlike other processing units such as catalytic crackers, some cokers are maintained as standby capacity while other units are operated at variable levels. When distillate-fuel demand is high with relation to heavy residual fuel, cokers are operated at capacity or in some cases above that rated figure. However, when the price of heavy fuel improves and distillate stocks are building up, coking operations can be cut back, and some units are shut down. As a result, coking operations in this country fluctuate at around 80 to 85 per cent of total capacity.

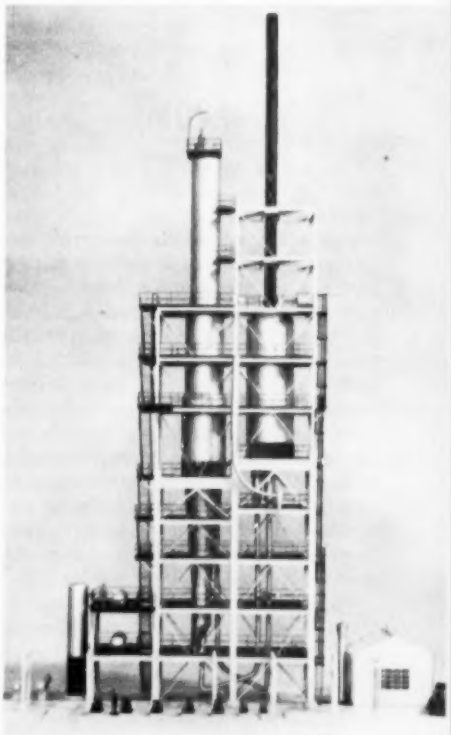
Coke production . . . New light recently shed on the compilation of Bureau of Mines statistics of coke production in this country has given a much truer picture of actual output of marketable petroleum coke. For several years, some refiners have been including in their reports to the bureau, their production of the carbon or coke laid down on catalyst in catalytic cracking units. While this is accepted practice in deriving plant-product balances, it results in erroneously high production figures when they are taken to represent the production of marketable coke from conventional coking units.

Moreover, the practice of reporting catalyst coke production has not been uniform, so the coke production of United States refineries as reported by the Bureau of Mines for the past several years has represented nothing more than total marketable coke from coking units plus a fraction of the coke laid down on catalyst and burned in regenerators.

Revised figures . . . Last year for the first time, the bureau was able to differentiate between catalyst coke and marketable coke in reports submitted to it. Hence, figures for 1953 and later years will show the amounts of catalyst coke included in the total figures.

For the first 10 months of 1953, catalyst coke amounted to 41 per cent of total coke reported to the bureau. Hence, estimated 1953 production of marketable coke produced in coking units will be on the order of 2,536,000 short tons as compared with the estimated total of 4,315,000 short tons reported by refiners. It is not possible to carry the corrections back to past years since the proportion of catalyst coke production is not known. However, the coke output reported for the postwar years has exceeded the capacity of existing coking units and is

This is a model of the 3,000-bbl. per day fluid coking unit now under construction at Billings, Mont., by Carter Oil Co. Of the 80,400 bbl. per day in coking capacity now under construction or planned in this country, 50,000 bbl. per day is represented by three fluid cokers of this type.



believed to have included from 25 to 40 per cent of nonmarketable coke laid down on catalyst in some cracking plants.

Nonfuel uses important . . . When comparing the consumption of coke with the marketable production, it appears that a smaller fraction than previously realized remains available in this country for disposal as fuel. Table 2 outlines in rough estimates the disposition of coke for the past 2 years, and the probable channeling of this year's production. The marketable production for 1952 is estimated from the comparative levels of catalytic cracking in 1952 and 1953, assuming those refiners who reported catalyst coke production were consistent in their reports for both years. The estimated 1954 production is based on new capacity and continuation of coking operations in existing units at roughly the same level as in 1953.

Industrial uses . . . It is noted that well over half of the total green petroleum coke produced last year found its way into four important industrial uses. The aluminum industry continues to be the largest ultimate consumer of coke, in the form of carbon anodes employed in the electrolytic recovery of primary aluminum.

These carbon electrodes are consumed at the rate of 65 lb. for every 100 lb. of aluminum produced. The

carbon paste of which they are made consists of 52 lb. of both green and calcined petroleum coke and 14 lb. of coal-tar pitch, which is used as a binding agent. Of the 52 lb. of coke, 21 lb. is added as green coke and 31 lb. as calcined coke flour. Since it takes about 100 lb. of green coke to make 72 lb. of calcined coke, the calcined product represents 43 lb. of green coke. Hence, 64 lb. of green petroleum coke is required to produce 100 lb. of aluminum. The figures given are averages, and specific operations may depart from them to some extent.

Domestic aluminum production increased 33 per cent last year, rising from 1,874,664,367 lb. in 1952 to an estimated 2,500,000,000 lb. in 1953. Current production is at the rate of 2,784,000,000 lb. and the industry is expected to reach the 2,938,000,000-lb. level by June 30.

"For first 10 months of 1953, catalyst coke amounted to 41 per cent of total coke reported."

TABLE 1—PETROLEUM COKING UNITS IN THE UNITED STATES

Company, plant location, type process—	Charge capacity, BPSD	Coke capacity, tons/SD
Carter Oil Co.:		
Billings, Mont. (F)	*3,800	*150
Cities Service Oil Co. (Del.):		
East Chicago, Ind. (D)	8,900	280
Ponca City, Okla. (O)	1,950	100
Continental Oil Co.:		
Ponca City, Okla. (D)	7,200	400
Ponca City, Okla.	*12,500	
Esso Standard Oil Co.:		
Baltimore (F)	†10,000	†400
Baton Rouge (F)	†20,000	†800
Frontier Refining Co.:		
Cheyenne, Wyo. (D)	3,500	115
General Petroleum Corp.:		
Torrance, Calif. (D)	26,000	1,100
Kendall Refining Co.:		
Bradford, Pa. (O)	1,500	20
Magnolia Petroleum Co.:		
Fort Worth (D)	5,300	115
McMurrey Refining Co.:		
Tyler, Tex. (D)	10,000	75
Natl. Co-op. Ref. Assn.:		
McPherson, Kans. (D)	9,000	250
Ohio Oil Co.:		
Robinson, Ill. (D)	6,000	250
Pan-Am Southern Corp.:		
Destrehan, La. (D)	10,000	330
El Dorado, Ark. (D)	10,000	400
Portland Gas & Coke Co.:		
Portland, Ore. (O)	1,500	35
Pure Oil Co.:		
Toledo (D)	5,000	175
Seattle Gas Co.:		
Seattle (O)	4,000	100
Shell Oil Co.:		
Wood River, Ill. (O)	15,000	800
Socony-Vacuum Oil Co.:		
Trenton, Mich. (D)	4,000	145
E. St. Louis, Ill. (D)	9,000	240
Standard Oil Co. (Ind.):		
Casper, Wyo. (O)	2,500	118
Neodesha, Kans. (O)	5,100	85
Sugar Creek, Mo. (O)	30,400	505
Whiting, Ind. (D, O)	41,000	930
Wood River, Ill. (O)	3,740	126
Standard Oil Co. (Ohio):		
Lima, Ohio (D)	19,500	320
Lima, Ohio (D)		
Toledo (D)	7,000	180
Texas Co.:		
Amarillo, Tex. (O)	4,000	100
Amarillo, Tex. (D)	*3,600	*100
Casper, Wyo. (O)	4,000	100
El Paso, Tex. (D)	*2,800	*89
Lockport, Ill. (O)	12,000	250
Port Arthur, Tex. (O)	7,000	200
Ucan Products Co.:		
Duncan, Okla. (D)	*9,000	*360
Union Oil Co. of Calif.:		
Rodeo, Calif. (D)	20,000	1,000
Santa Maria, Calif.	†20,000	
Total operating capacity	294,090	8,844
Total capacity contracted or planned	81,700	1,899
Total	375,790	10,743

*Under construction. †Planned.

D—Delayed coking, U.O.P. chamber, Blaw-Knox decarbonizing.

F—Fluid, including pressure type, two-coil, Hughes, etc.

O—Chamber type coking.

This expansion in aluminum production looms important from the standpoint of petroleum-coke demand. Consumption ran 600,000 short tons in 1952, representing 27 per cent of marketable coke produced in this country. This year, roughly one-third of the petroleum coke outlet will be consumed by the aluminum industry alone.

Most of the petroleum coke which goes into nonfuel uses is sold by refiners on long-term contracts to companies which calcine the product for subsequent manufacture of anodes, electrodes, and other industrial products. In addition, the aluminum manufacturers themselves are entering more and more into the coke market to purchase green coke for making their own anodes. Last year the aluminum companies consumed about 18 per cent of their total coke requirements in the form of green coke, purchased directly from refiners or through middlemen.

The specifications laid down by the aluminum industry for green and calcined coke show some variations among companies. They are summarized in Table 3. Green coke meeting these requirements should bring a fairly

TABLE 2—UNITED STATES PETROLEUM COKE ESTIMATED PRODUCTION AND DEMAND

(In 1,000's short tons/year)

	1952	1953	1954
Production	2,215	2,536	2,700
Domestic requirements:			
Aluminum anodes	596	794	940
Electrodes	320	345	350
Carbide	190	170	160
Abrasives	81	87	90
Fuel and misc.	151	416	310
Total domestic	1,338	1,812	1,850
Exports	877	724	850
Total demand	2,215	2,536	2,700

TABLE 3—SPECIFICATIONS OF PETROLEUM COKE FOR MANUFACTURE OF ALUMINUM ANODES

	Green	Calcined
Volatiles, per cent max.	12.0	0.5
Ash, per cent max.	0.5-1.0	0.5-0.8
Calcium, per cent max.	0.12	0.12
Iron, per cent max.	0.06	0.05-0.08
Silicon, per cent max.	0.06-0.08	0.05-0.08
Sodium, per cent max.	0.12	0.12
Combined Fe-Si, per cent max.	0.14	0.14
Combined Na-Ca, per cent max.	0.12-0.15	0.15
Soluble salts, per cent max.	0.2-0.8	0.8
Sulfur, per cent max.	1.5-2.0	1.0-2.0
Real density		2.01-2.07

"Although the nonfuel uses for petroleum coke appear to be expanding, it is likely that the trend toward coking in the refining industry will cause the future supply to rise even faster."

good price, provided shipping distances are not too great.

Calcining coke . . . Companies engaged in calcining coke do not place such rigid limits on sulfur and ash, since for the most part they are able to meet the calcined-coke specifications of their customers by blending off poor cokes or by selling some of the lower grades as fuel. At the present time, exclusive of aluminum producers, four companies are engaged in calcining coke in this country. Their nine plants located throughout the country have a total capacity for calcining over 1,500,000 tons of green petroleum coke per year. Of the four companies, Great Lakes Carbon Co. dominates the field with 77 per cent of capacity, while National Carbon Co. division of Union Carbide & Carbon Co. operates about 14 per cent of capacity and R. T. Collier Co. and International Graphite & Electrode Co. operate 6 and 3 per cent respectively.

The concentration of coke purchasing among a few large buyers has resulted in a complete absence of published price quotations. Refiners are receiving from about $5 to $20 per ton for their product, the prices reflecting the quality, quantity, and distance from market. Most of the product meeting green-coke specifications set by the aluminum manufacturers brings $10 to $14 per ton. Some refiners have signed long-term contracts which bind the buyer to take their full output in whatever quality and quantity it is produced. In some areas, such as Toledo and Chicago, refiners are receiving $8 to $12 per ton for coke going into domestic fuel markets.

Miscellaneous end uses . . . In addition to the major industrial uses for electrode, carbide, and abrasive manufacture, coke is finding its way into many other products. Since most if not all of these markets are served by the major buyers who calcine the coke, their development may not be apparent to the refiner in either the volume sold or the price realized on his green coke.

Carbon brushes account for a small volume but a relativeley large dollar return. Much of the coke calcined by some companies is used directly for the manufacture of dry-cell-battery cores and battery fillers.

Structural carbon is in growing demand for the fabrication of pipes, fittings, Raschig rings, and valves used in handling highly corrosive chemicals. Research efforts are under way to discover some method whereby petroleum coke could be substituted for high-cost charcoal in the synthesis of carbon disulfide. If successful, this would open a potential market for an additional 40,000 to 50,000 tons per year of petroleum coke.

Electric-Steel Production

The consumption of coke in the form of other electrodes is tied mainly to the level of electric-steel production, and the recovery of other metals such as zinc and magnesium. While production of electric steel is currently high, this phase of steel manufacture can fluctuate widely, and the present consumption of electrodes could decline sharply as it has in the past.

Petroleum coke is also the principal source of carbon for the manufacture of silicon carbide abrasives, which account for about 4 per cent of total current coke production. The product, to meet this end use, must not exceed 1 per cent in sulfur or ash content, and must test less than 9 per cent of volatile matter.

Calcium carbide manufacturers still consume roughly 10 per cent of total coke production in this country. For this purpose, coke must have less than 2 per cent ash, 13 per cent volatile matter, and 1 per cent sulfur. Phosphorus content must not exceed 0.1 per cent.

In general, petroleum coke must compete with other sources of carbon for most of these end uses excepting aluminum anodes. Hence, the demand and consumption will vary widely depending on the relative availability and price of competing raw materials. The figures in Table 2 represent the best available estimates of these end uses, since no reliable records of actual consumption exist.

Still another new market has been developed in the filter aid field. Great Lakes Carbon Co. recently announced a free-flowing grade of carbon with porosity and permeability similar to diatomaceous earth. This new filter aid, which is over 90 per cent carbon, is completely resistant to alkaline solutions. It is made from petroleum coke and other carbonaceous materials in a high-temperature furnace process, at the current rate of 6 tons per day. As demand grows, the company expects to expand production.

Calcining problems . . . Companies engaged in the preparation of green coke for various industrial uses have been running tests on coke produced by the new continuous contact and fluid processes. In general, they feel that these new cokes, because of their hardness, will not calcine as satisfactorily as delayed coke.

Hence, it is possible that the coke production from proposed units employing the new processes will initially find its market mainly as fuel. As a result, the nonfuel market for coke production from delayed cokers and pressure cokers currently in operation, may be expected to improve with the expansion in demand for aluminum anodes, electrodes, and other end uses requiring a calcined coke.

Since the market for byproduct coke has little influence on the refiner's decision to adopt coking, or on his choice of a coking process, this objection on the part of buyers to fluid and continuous contact coke will probably have little effect on its future production. The refiner's principal concern is the quality and yield of distillates to be obtained from coking heavy residual fractions, and while the returns he may receive from the coke itself are sometimes taken into consideration, they are of secondary importance.

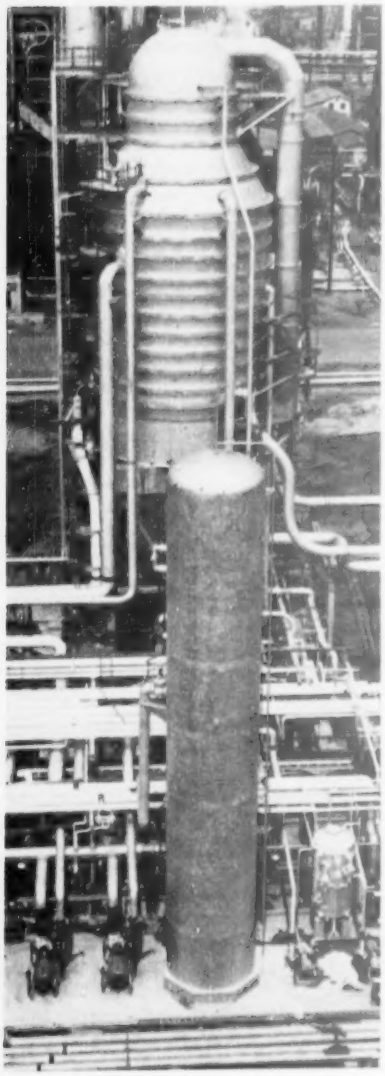
Fuel uses . . . Although the nonfuel uses for petroleum coke appear to be expanding, it is likely that the trend toward coking in the refining industry will cause the future supply to rise even faster. This will divert increasing amounts of coke to fuel uses.

As industrial fuel, petroleum coke may be burned alone, or blended off with coal. Experimental use of coke in a spreader stoker proved the fuel to be highly efficient provided certain precautions were taken. The principal hazard results from the very low ash content which causes grates to burn out. With some modification in grate design, stoker burning of straight petroleum coke could prove economical.

Most of the coke consumed by industry is burned in pulverized form. Like heavy residual fuel, some coke runs relatively high in sulfur and vanadium content, which may limit use at very high furnace temperatures or low tail-end temperatures.

Coke produced by the delayed-coking and pressure-coking processes pulverizes satisfactorily. Difficulty is anticipated, however, in the pulverizing of the harder, partially calcined production of the continuous contact coking and fluid coking processes. Preliminary tests on fluid coke by a major combustion-equipment manufacturer indicate that it will cost on the order of 50 cents per ton to pulverize fluid coke. Due to the much lower volatile contents of these new cokes, they may have to be burned together with other more volatile fuels since they show difficulty in maintaining ignition.

The greater hardness and lower volatile content of these new cokes may render them better adaptable to other end uses than conventional coke produced today. Market-analysis studies now under way indicate that both contact coke pellets and fluid coke will burn satisfactorily in stokers when blended off with coal, and should command a good market due to their high B.t.u. value. Extensive market research is being conducted to determine other end uses to which these new coke forms may be particularly well adapted.



VACUUM DISTILLATION is one process used by refiners to reduce residual yield. Vacuum column is shown in background.

Refinery fuel . . . Although internal consumption of coke in refineries appeared to be rising in recent years, actually very little production of coking units is so consumed. The figures reported to the Bureau of Mines have included coke laid down on catalyst, and the estimates of reported tonnage of this type of coke in recent years account for most of the total consumption shown.

Domestic fuel . . . The home-heating market for petroleum coke has not been developed to any extent, although it offers possibilities. Its competitive position has improved with the rising price of coal. A sizable market exists in the Middle West and the demand might improve if coke were better packaged for home consumption. Some briquetting is being done, in most cases with blends of petroleum coke and anthracite coal.

Exports . . . The trend in exports of petroleum coke since the war has been sharply upward, in contrast with some other petroleum products. Overseas shipments rose from 386,000 short tons in 1946 to a peak of 894,000 tons in 1951, and leveled off to about 724,000 tons last year. While much of the end use of exported coke is for fuel, the expanding aluminum industry in Canada and elsewhere will tend to sustain foreign demand for nonfuel uses.

Heavy Fuel Oil

(Continued from page 147)

bines could never operate satisfactorily on run-of-the-mill residual fuels. Progress in the study of the many additives reported by European and American investigators is now believed to be bringing this research effort near to a successful conclusion.

Numerous elements now appear to offer desired results at low cost. Among the many which have been investigated, aluminum, magnesium, zinc, and silicon, the latter in the form of diatomaceous earth or ethyl silicate show considerable promise. Successful adaptation will entail not only the selection of a low-cost additive but the development of its successful handling and introduction to gas turbine fuel.

Investigators close to the problem believe that development is imminent, of an all-round additive which will successfully combat both deposition and corrosion at low cost. When and if this additive becomes available, it should herald the coming of an important new market for residual fuel. It is considered possible that the residual-fueled gas turbine might then prove competitive with the diesel engine, eventually to reverse the recent trend from heavy fuel oil to diesel fuel in railroad usage.

A successful low-cost additive of the type now considered possible of development would also assure the continued consumption of residual fuels in both marine and stationary steam power plants which today account for a large segment of their end use. The potential advantages to be gained from success in this field of research justify the close attention of refiners everywhere.

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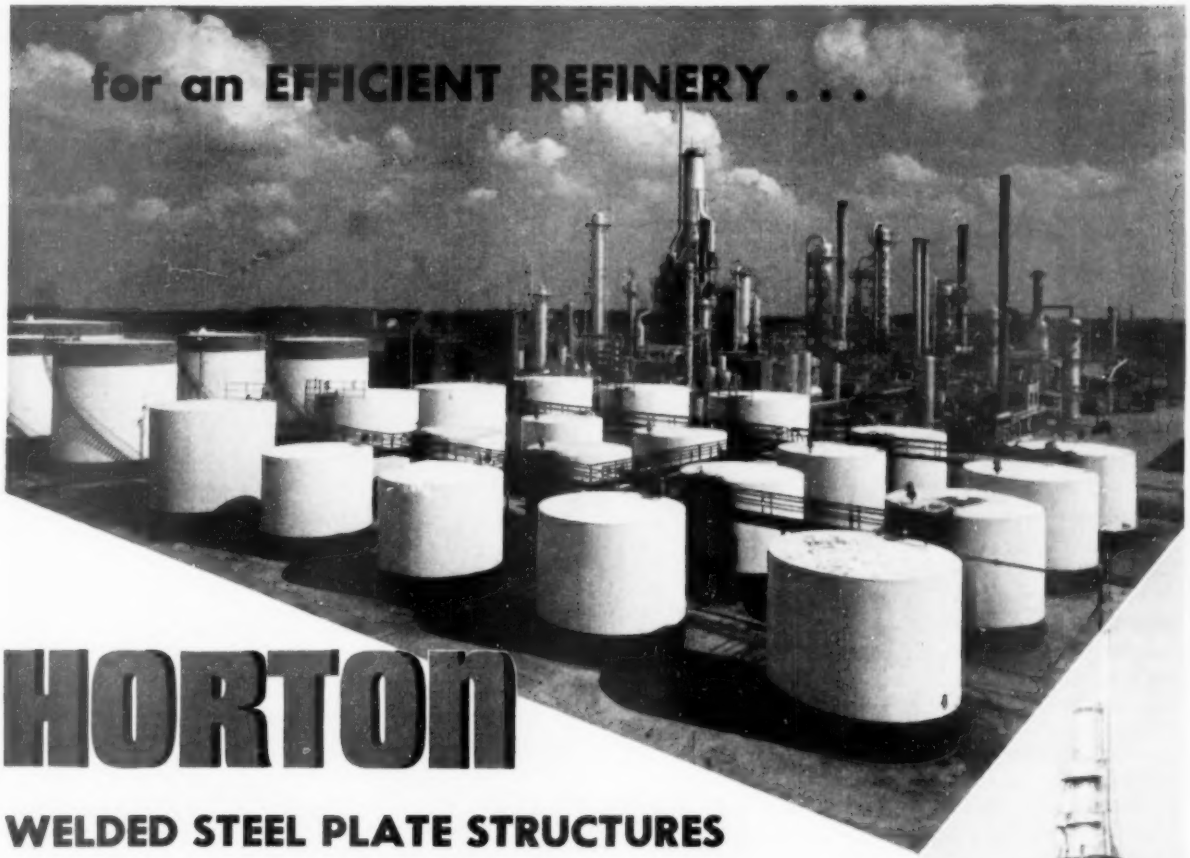

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Top: View of Rock Island Refining Corporation refinery at Zionsville, Indiana. Lower: Catalytic cracking unit at the Rock Island Refinery. CB&I supplied the reactor-regenerator unit for this cat cracker.

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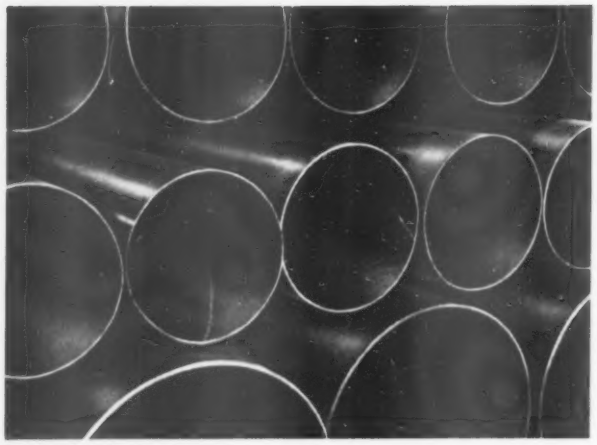
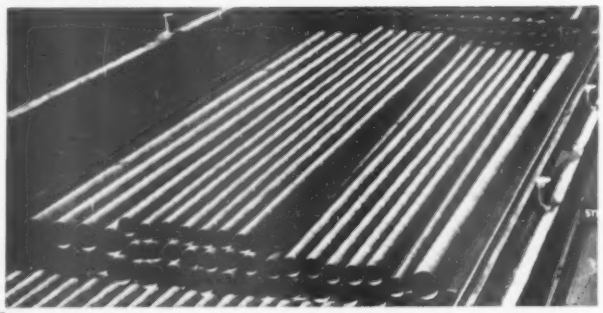
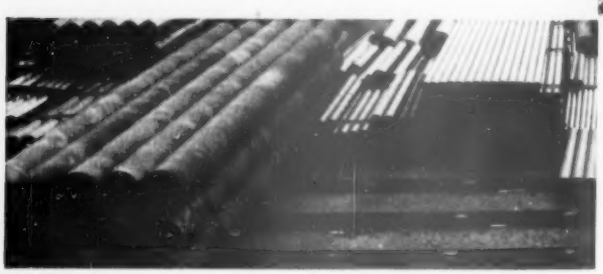


Wide wall thickness range

Uniform lengths



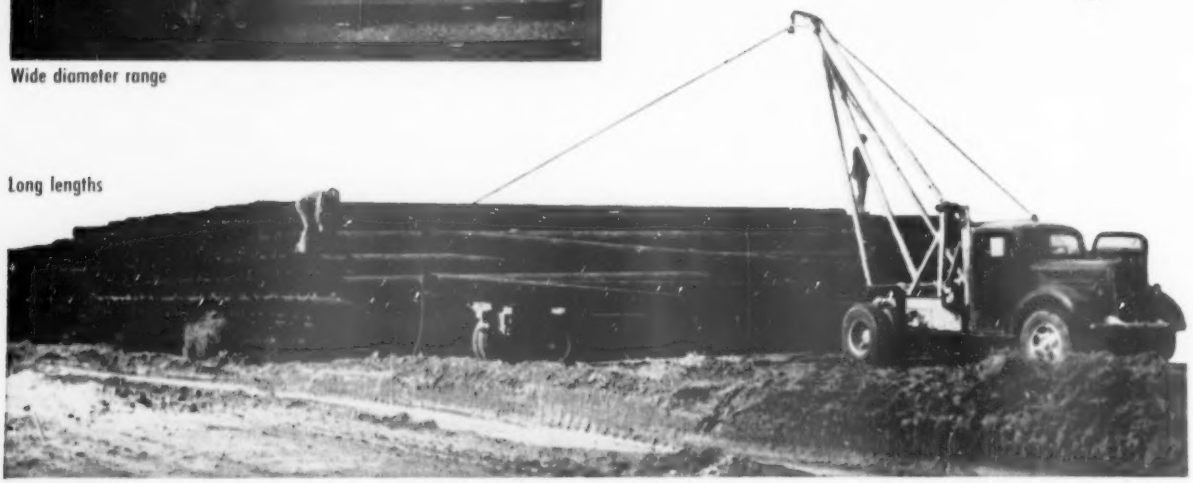


Wide diameter range

ARMCO WELDED STEEL PIPE

ARMCO

Long lengths



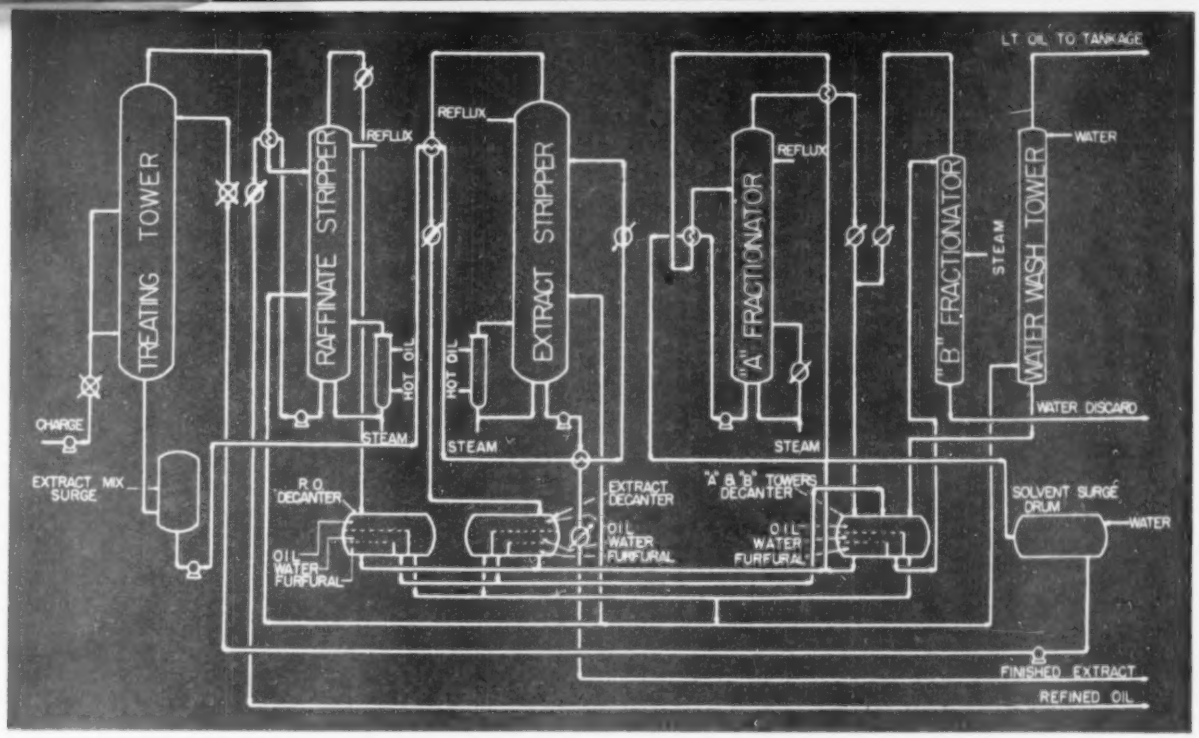


Fig. 1—Schematic flow diagram of furfural refining unit at The Texas Co.'s Eagle Point refinery.

Furfural Refining Scores on Four Counts

. . . in improving quality of cat cycle gas oils and virgin distillates

by R. T. Carter

THE application of furfural refining to the cycle gas oils produced from catalytic cracking units is a successful and versatile process. This is borne out by more than 4 years of plant experience.

The Texas Co. has operated a commercial furfural refining unit designed for processing catalytic cycle gas oils[1,2] since December 1949, at its Eagle Point, N. J., refinery. Summarized results show:

- A high yield of refined oil, having low-sulfur content and high cetane rating, can be recovered by furfural refining high-sulfur-content cycle oils.
- Extraction of high-sulfur virgin distillates, or light cycle gas oil in variable combination with heavy cycle gas oil, results in a high yield of refined oil having a low sulfur content. A.P.I. gravity is several degrees higher than that of the feed stock.
- Heavy metals are removed by extraction of heavy cycle gas oil. Es-

Author is associated with The Texas Co., Westville, N. J.

TABLE 1—FURFURAL REFINING OF LIGHT CATALYTIC CYCLE GAS OIL

Run number		1		2		3		4		5	
Refined oil yield, vol. per cent charge from unit weight balance		71.1		73.9		75.8		79.3		72.7	
STREAM QUALITY	Charge	Refined Oil	Extract	Refined Oil	Extract	Refined Oil	Extract	Refined Oil	Extract	Refined Oil	Extract
Gravity — °A.P.I.	31.4	41.6	10.5	40.6	10.0	39.8	10.0	38.2	10.1	41.1	10.2
Distillation — °F.											
I.b.p.	484	485	500	460	506	478	502	483	500	481	504
10%	505	504	510	497	519	500	517	503	512	501	518
50%	528	528	534	525	540	525	538	527	534	527	540
90%	567	570	582	566	588	565	589	567	590	568	586
E.p.	595	596	628	592	631	592	630	596	632	595	630
Viscosity — S.s.U. @ 100° F.	36.1	36.5	37.5	36.3	37.9	36.4	37.6	36.3	37.6	36.5	37.9
Pour point, °F.	+5	+15	—	+15	—	+10	—	+10	—	+15	—
Aniline point, °C.	59.1	80.7	—	79.6	—	75.6	—	73.4	—	79.6	—
Sulfur, wt. %	1.10	0.19	2.96	0.25	3.08	0.35	3.10	0.44	3.15	0.23	3.04
Cetane number	42.5	64.2	—	61.8	—	60.0	—	57.0	—	63.0	—

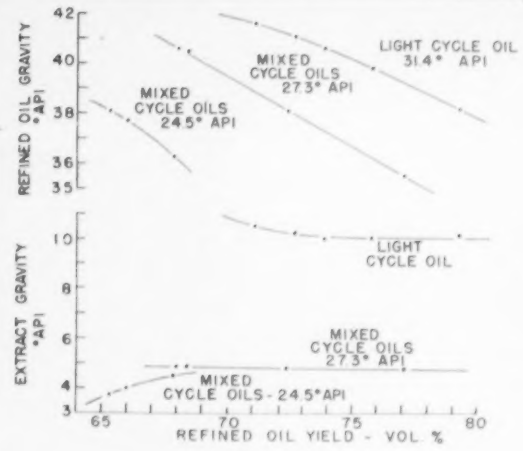

REFINED OIL GRAVITY °API
LIGHT CYCLE OIL 31.4° API
MIXED CYCLE OILS 27.3° API
MIXED CYCLE OILS 24.5° API
EXTRACT GRAVITY °API
LIGHT CYCLE OIL
MIXED CYCLE OILS 27.3° API
MIXED CYCLE OILS - 24.5°API
REFINED OIL YIELD - VOL %

Fig. 2.

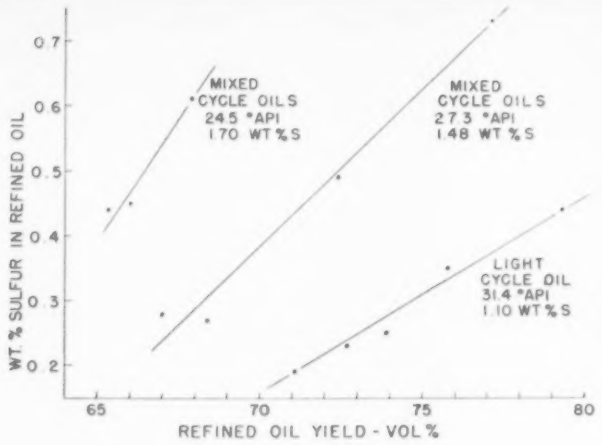

WT. % SULFUR IN REFINED OIL
MIXED CYCLE OILS 24.5 °API 1.70 WT % S
MIXED CYCLE OILS 27.3 °API 1.48 WT % S
LIGHT CYCLE OIL 31.4 °API 1.10 WT % S
REFINED OIL YIELD - VOL %

Fig. 3.

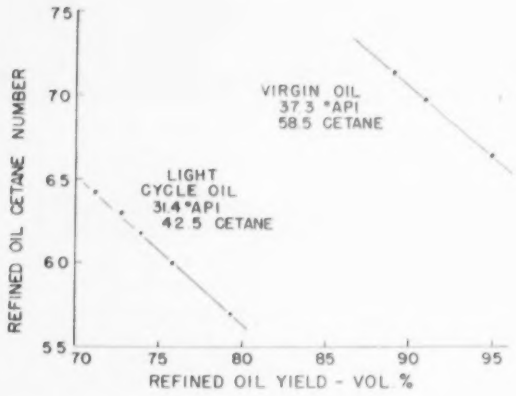


Fig. 4.

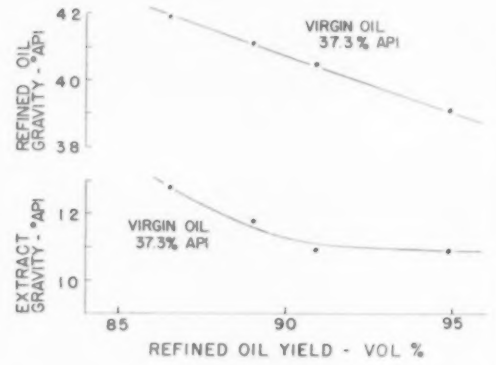


Fig. 5.

"... catalytic cracking of furfural-refined cycle oil will produce a product distribution comparable to that obtained in the cracking of the original virgin oil of similar boiling range."

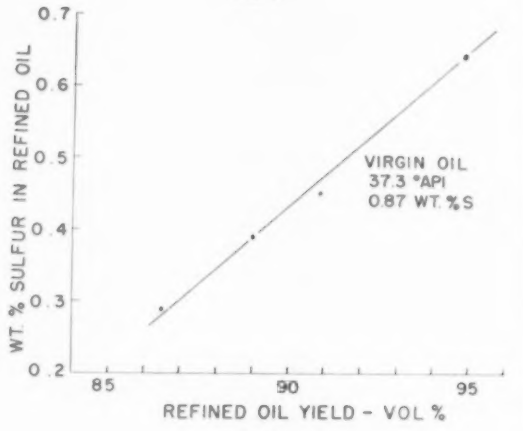


Fig. 6

sentially all vanadium removed from Eagle Point heavy cycle oil.

● Cat cracking of furfural-refined oil results in a product distribution comparable to that obtained in cracking virgin gas oil of similar boiling range. Refined oil undergoes less conversion, but produces an equal total-butane-retention gasoline yield. Refined oil produces more butane and less dry gas.

Product gasoline from cracking refined oil has lower sulfur content, higher octane rating, and lower average boiling point. Light cycle gas oil produced from refined oil has lower sulfur content and appreciably higher aniline point than that obtained from virgin gas oil.

Process Design

The process flow through the Eagle Point furfural unit is shown schematically in Fig. 1. The unit was designed to charge 8,000 bbl. per stream day of light catalytic cycle gas oil having a boiling range suitable for diesel fuel or for domestic heating oil. The furfural extraction of the charge oil is effected by countercurrent flow of solvent and oil through a Raschig-ring-packed column, the equipment being designed to employ a volume of solvent as high

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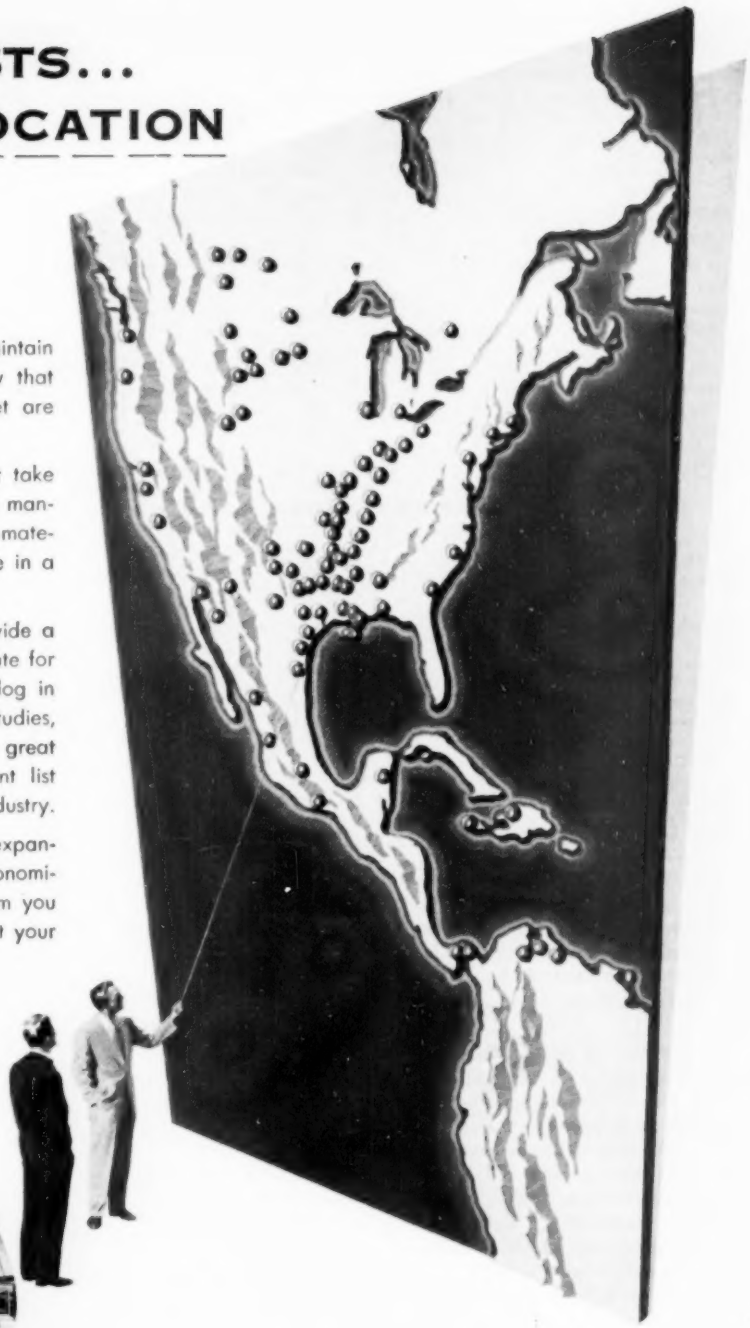
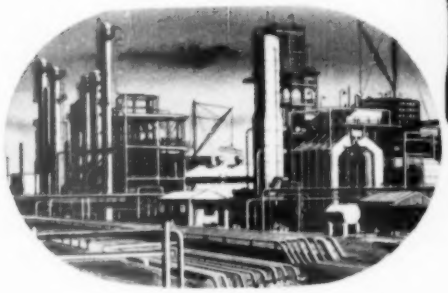
If you are planning new construction or expansion, Brown & Root's experience in fast, economical completion can benefit you. A call from you will put Brown & Root's planning experts at your disposal. No obligation, of course.





A large part of Brown & Root's activity has centered around the process industries in the design and construction of plants for heavy chemical, petroleum, petro-chemical and organic chemical fields.

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TABLE 2—FURFURAL REFINING OF VIRGIN DISTILLATE

Run number		6		7		8		9	
Refined oil yield, vol. per cent from unit weight balance		86.5		89.0		90.9		94.9	
STREAM QUALITY:	Charge	Refined oil	Extract	Refined oil	Extract	Refined oil	Extract	Refined oil	Extract
Gravity, °A.P.I.	37.3	41.9	12.8	41.1	11.8	40.5	10.9	39.1	10.9
Distillation, °F.:									
I.b.p.	468	466	504	468	512	468	510	482	510
10 per cent	497	494	522	497	524	494	522	506	525
50 per cent	531	528	546	530	548	529	548	537	551
90 per cent	583	583	605	584	606	581	609	587	614
End point	625	622	655	625	654	624	658	626	662
Viscosity, S.s.U. at 100° F.	37.0	36.9	40.2	36.9	40.6	37.0	40.4	37.5	41.0
Point point, °F.	+5	+10	(*)	+15	(*)	+10	(*)	+10	(*)
Carbon residue, wt. per cent in 10 per cent bottoms	0.018	0.009	0.63	0.018	0.78	0.020	0.81	0.013	1.24
Aniline point, °C.	72.0	81.4	(†)	80.0	(†)	78.4	(†)	76.6	(†)
Sulfur, weight per cent	0.86	0.29	3.94	0.39	4.09	0.45	4.23	0.64	4.47
Cetane number	58.5			71.5		69.9		66.6	

*Pour point of all extract samples was below —30° F. †Aniline point of all extract samples was below +25° C.

TABLE 3—FURFURAL REFINING OF MIXED CATALYTIC GAS OILS

Run number		10		11		12		13	
Refined oil yield, vol. per cent from unit weight balance		77.1		72.4		68.4		68.0	
STREAM QUALITY:	Charge	Refined oil	Extract	Refined oil	Extract	Refined oil	Extract	Refined oil	Extract
Gravity, °A.P.I.	27.3	35.5	4.8	38.1	4.8	40.5	4.9	40.6	4.9
Distillation, °F.:									
I.b.p.	478	480	496	482	492	482	493	482	490
10 per cent	504	503	513	506	514	503	514	502	509
50 per cent	538	534	580	536	579	532	572	532	567
90 per cent	725	682	*750	671	*746	663	*731	672	*732
End point									
Viscosity, S.s.U. at 100° F.	39.7	38.0	54.7	38.1	53.7	38.1	51.8	38.5	51.5
Aniline point, °C.	61.4	75.3		80.0		84.8		85.0	
Sulfur, weight per cent	1.48	0.73	3.57	0.49	3.59	0.26	3.54	0.28	3.64

*A.S.T.M. distillation 80 per cent point.

as one volume per volume of charge oil. Tubular heat-exchange equipment was provided to control the extraction temperature within an advantageous range.

The refined oil leaving the top of the treating tower is stripped free of furfural in a bubble-cap tray tower, employing a circulating hot-oil system as the heat source to the stripper reboiler. Facilities are provided that permit stripping furfural from a charge oil containing low-boiling hydrocarbons. The extract leaving the bottom of the treating tower is stripped free of solvent in a second similiarly equipped bubble-cap-packed tower.

Solvent recovery . . . The overhead vapor leaving both strippers is condensed separately and enters separate decanters where water and furfural are separated by gravity. Depending on the initial boiling point of the raw-oil charge, a light oil phase may separate in these decanters. Suitable equipment is available on the unit to permit the recovery of furfural and oil from this layer, the oil being disposed of as raffinate or extract depending on its quality.

The solvent removed from the de-

TABLE 4—FURFURAL REFINING OF MIXED CATALYTIC CYCLE GAS OILS

Run number		14		15		16	
Refined oil yield, vol. per cent from unit weight balance		67.9		66.0		65.3	
STREAM QUALITY	Charge	Refined Oil	Extract	Refined Oil	Extract	Refined Oil	Extract
Gravity — °A.P.I.	24.5	36.3	4.5	37.7	4.0	38.1	3.7
I.b.p.	480	484	494	484	492	481	495
10 per cent	506	505	517	504	514	503	519
50 per cent	557	546	606	544	604	544	608
90 per cent	749	724	*710			724	*708
E.p.							
Viscosity — S.s.U. @ 100° F.	42.9	40.1	61.9	40.0	61.5	40.3	62.4
Pour point, °F.	+10	+55		+50		+50	
Aniline point, °C.	60.7	79.8		82.5		83.0	
Sulfur, wt. per cent	1.70	0.61	3.59	0.45	3.52	0.44	3.63

*A.S.T.M. distillation 70 per cent point.

TABLE 5—PROCESSING VIRGIN AND REFINED OILS COMPARISON OF OPERATING CONDITIONS

PROCESS CONDITIONS	Virgin Oil Charge	Refined Oil Charge
Reactor		
Gas-oil charge, bbl. per day	31,224	30,960
Gas-oil recycle, bbl. per day	5,220	5,220
Net slurry oil return to reactor, bbl. per day	1,860	1,860
Catalyst in reactor, tons	229	229
Bed temperature, °F.	923	921
Catalyst circulation, tons per thousand	35.4	33.9
Steam to spent catalyst Stripper, M. lb. per hour	16.2	16.2
Regenerator		
Total air to regenerator, M. lb. hour	278	292
Catalyst in regenerator, tons	242	258
Bed temperature, °F.	1,098	1,099
Oxygen in flue gas, Vol. per cent	2.3	2.8
Carbon on regen. cat., wt. per cent	0.92	0.84

TABLE 6—PROCESSING VIRGIN AND REFINED OILS PRODUCT QUALITY

GAS-OIL CHARGE	Virgin Oil Charge	Refined Oil Charge
°A.P.I.	30.4	34.1
A.S.T.M. distillation, °F.		
I.b.p.	448	482
10 per cent	506	526
50 per cent	648	591
90 per cent	750	760
Sulfur, wt. per cent	1.10	0.47
Carbon residue, wt. per cent	0.070	0.023
Aniline point, °C.	82.6	83.2
Nitrogen, wt. per cent	0.082	0.018
Viscosity, S.s.U. @ 100° F.	60.9	45.7

canters is combined and may be fractionated free of water and soluble oil. The overhead vapor from the A fractionator is condensed and enters the A and B decanter along with the overhead stream from the B tower.

Any water phase withdrawn from the refined oil and extract decanters enters the A and B decanter, and the water is then stripped of furfural in the B fractionator.

With the exception of the relatively small amount of steam injected into the several strippers and that consumed in shell-and-tube trim heaters for process control at low temperatures, the heat required in the operation is supplied from a circulating hot oil system which is not shown in Fig. 1.

Process Development

The initial operation of the furfural unit was limited to the refining of light catalytic cycle gas oils to produce: (1) low-sulfur content, high-ignition-quality diesel fuel; (2) domestic heating oil having superior combustion characteristics; and (3) a low-sulfur-content fluid catalytic cracking unit charge stock equivalent in cracking characteristics to a comparable boiling range virgin distillate.

In exploring the effect of solvent dosage on the quality of the refined oil product in the above operations, it became apparent, as indicated by previous laboratory work, that quite satisfactory refined oil quality could be obtained at solvent-to-oil ratios appreciably lower than the 100 per cent dosage provided for in the design of the unit.

By virtue of operating at low solvent dosages, approaching 25 volume per cent of the charge oil as a practical minimum, the capacity of the unit was increased to the point that it was possible to furfural refine the total cycle oil produced from the Eagle Point fluid catalytic unit, employing the refined oil produced from the heavy cycle oil as a supplementary, highly satisfactory catalytic cracking unit feed stock.

With no major equipment changes, the furfural unit currently processes light catalytic cycle gas oil for diesel fuel or domestic heating oil manufacture or processes a mixture of light and heavy cycle oils to produce catalytic cracking unit charge stock at charge rates of 11,000 to 14,000 bbl. per stream day. The solvent dosage employed varies depending upon the characteristics of the charge cycle oil and on the quality of refined oil required. In addition, virgin distillates boiling within diesel fuel or domestic-heating-oil range, are furfural refined to produce superior products for these uses.

Solvent selectivity . . . The design of the unit provided facilities whereby furfural containing various amounts of water could be circulated to the treating tower. Operating experience has demonstrated that the "wet" solvent is more selective, i.e. at a given quality improvement, as measured by cetane number, the use of wet solvent results in an improved yield of refined oil but requires a slightly greater solvent dosage. In addition, the use of wet solvent has been satisfactory in the treating tower so that at the low solvent dosages employed in the refining of catalytic cycle oils solvent containing water is normally used.

Significant quantities of light oil have not been produced in the decanters since the ASTM distillation initial boiling point of the cycle oil charge to the furfural unit is normally in the range of 470° to 480° F. Consequently, the water wash tower is operated only intermittently.

(Continued on page 172)

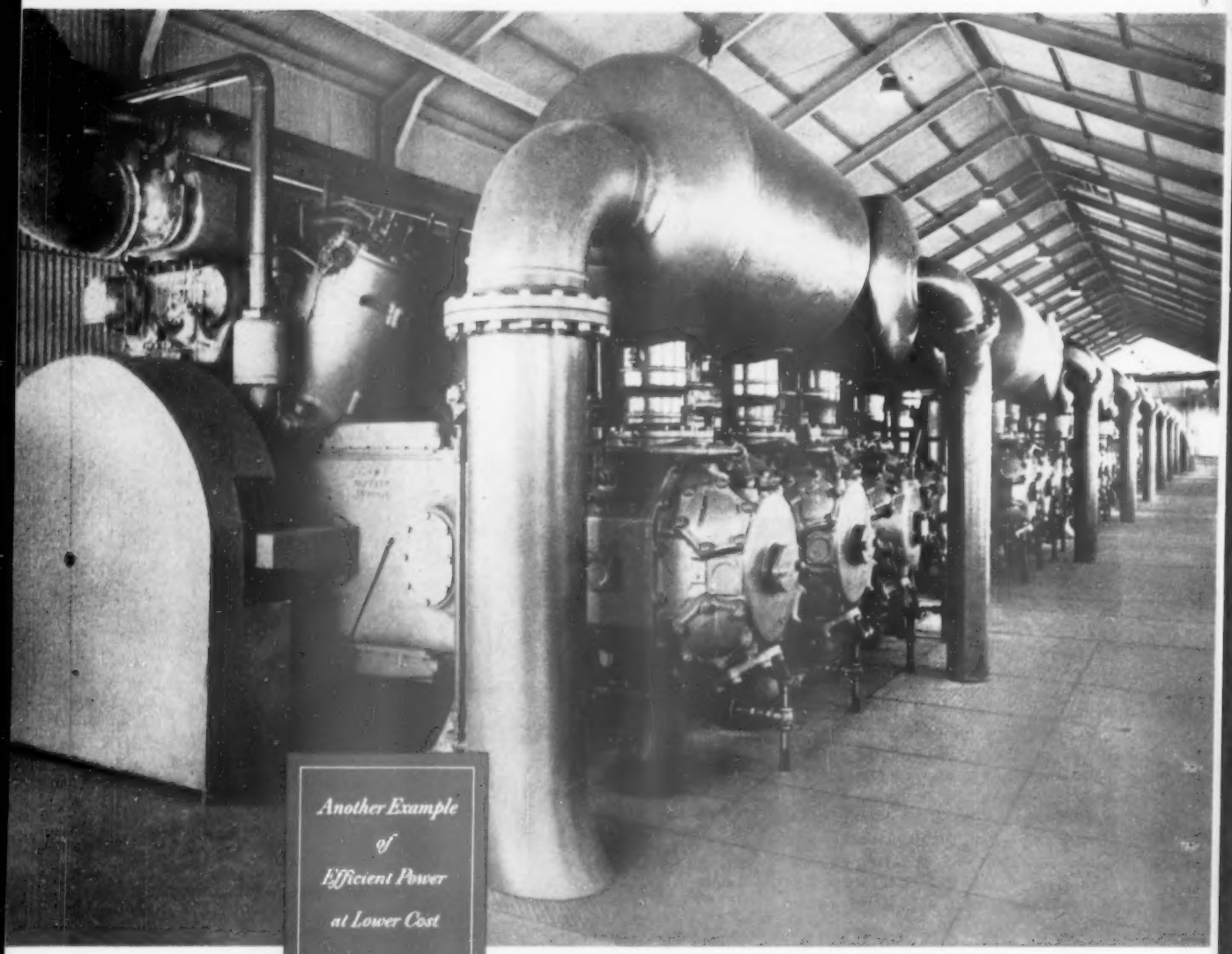
TABLE 7—PROCESSING VIRGIN AND REFINED OILS COMPARISON OF PRODUCT YIELDS

	Virgin oil charge		Refined oil charge	
YIELDS	Vol. %	Wt. %	Vol. %	Wt. %
Hydrogen sulfide		0.35		0.06
Hydrogen		0.10		0.09
Methane		1.61		1.54
Ethylene		0.59		0.61
Ethane		1.23		1.17
Propylene		3.19		2.35
Propane		1.89		1.70
Subtotal		8.96		7.52
Isobutane	3.63	2.34	6.64	4.42
Butylenes	5.19	3.56	7.77	5.42
Normal butane	3.23	2.16	2.89	1.99
Subtotal	12.05	8.06	17.30	11.83
Pentane to 430° F. v.t. Gasoline	38.97	33.63	32.88	29.14
Total cycle oils 430° F. v.t. i.b.p.	42.12	43.03	44.71	46.11
Coke		5.58		5.97
Total		99.26		100.57
Corrected 430° F. v.t. Conversion, Vol. per cent	57.88		55.29	

TABLE 8—PROCESSING VIRGIN AND REFINED OILS PRODUCT QUALITY

DEBUTANIZED GASOLINE PRODUCT	Virgin Oil Charge	Refined Oil Charge
°A.P.I.	59.0	61.9
Vol. per cent pentane	23.1	30.1
A.S.T.M. Distillation		
I.b.p.	99	106
10 per cent	128	128
50 per cent	214	191
90 per cent	350	334
E.p.	401	398
Sulfur, wt. per cent	0.135	0.037
Bromine No.	79.7	71.2
A.S.T.M. research octane		
Clear	92.9	93.8
Plus 3cc. TEL	98.1	98.9
LIGHT CYCLE GAS OIL		
°A.P.I.	30.1	33.2
A.S.T.M. distillation		
I.b.p.	486	504
10 per cent	506	522
50 per cent	534	540
90 per cent	583	575
E.p.	610	600
Sulfur, wt. per cent	0.77	0.46
Aniline point, °C.	58.5	68.5
Nitrogen, wt. per cent	0.017	0.013
Carbon residue in 10 per cent bottoms, wt. per cent	0.053	0.036
Viscosity, S.s.U. @ 100° F.	37.3	37.8

42,730 Cooper-Bessemer Horsepower Blankets Scurry County

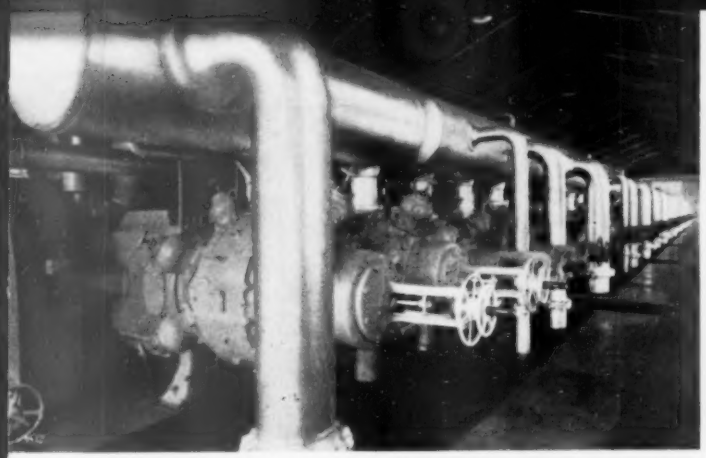


There are 13,200 Cooper-Bessemer compressor horsepower in this natural gasoline plant. Ten GMV-8-STF and two GMV-10-TF compressor units as well as six JS-5-G generating units each rated 375 hp at 400 rpm are in operation at the Diamond "M" Sharon Ridge Gasoline Plant operated by the Lion Oil Company.

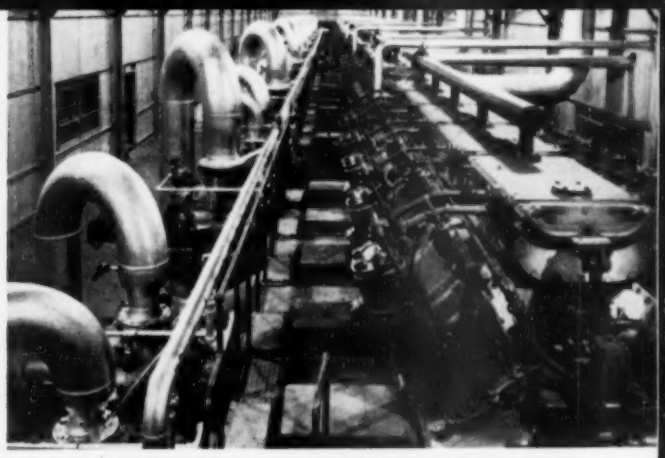
COMPRESSORS-GAS ENGINES-DIESELS

New York Washington, D. C. Bradford, Pa.

San Francisco, Cal. Houston, Dallas, Greggton, Pampa and Odessa, Texas Seattle, Wash.



The Snyder Gasoline Plant operated by Sunray Oil Corporation. In this, the largest Cooper-Bessemer powered plant in Scurry County, operating conditions are handled by twelve 1350 horsepower compressors. Also in operation are four JS-8-GTF engines rated 715 hp at 450 rpm.



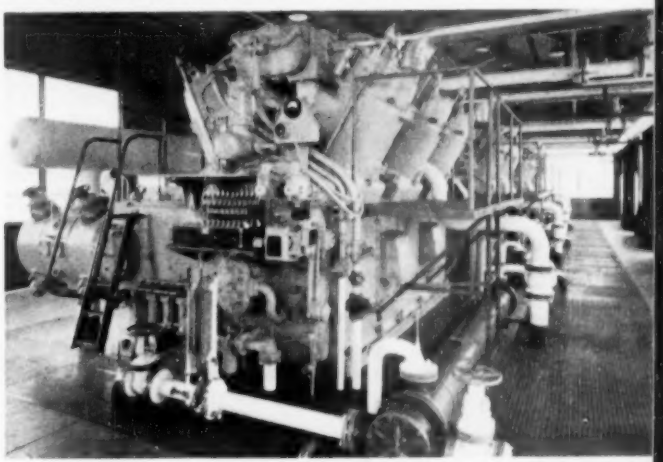
The Fuller Gasoline plant, operated by The Texas Company, contains five 880 hp GMV-8-TF units and three 110 hp GMV-10-TF units. In addition, three Cooper-Bessemer JS-8-GTF gas engines drive generators which provide electrical power.

● In the rich Scurry County oil and gas field, more and more Cooper-Bessemer horsepower has been added through the years, comprising an enviable record of top quality performance at low operating expense.

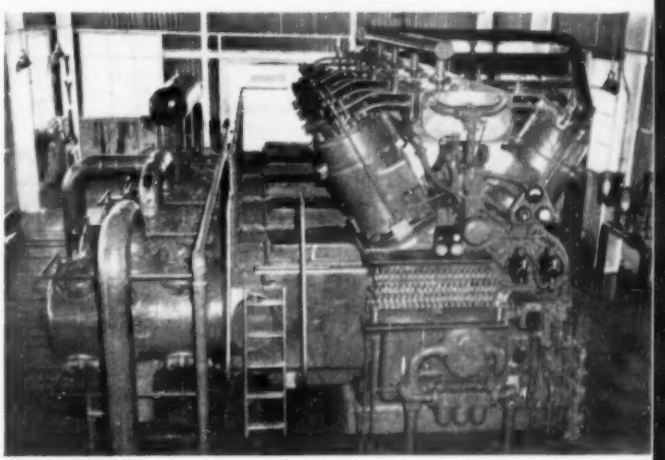
Engine driven compressor units for gas gathering, gas transmission, and various types of gas engines for driving auxiliaries and electric generators are only a few of the many jobs being capably handled by Cooper-Bessemers in this Texas area.

Such well-known organizations as El Paso Natural Gas Company, Lion Oil Company, Lone Star Gas Company, Sunray Oil Company and The Texas Company have installed Cooper-Bessemer units to meet their power requirements in Scurry County.

If you have compressor or generating problems, consult your nearest Cooper-Bessemer office. For compactness, efficiency, long service life, minimum supervision, and low installation and maintenance costs, you can't top Cooper-Bessemer.



Four Cooper-Besemer GMV-6-TF gas engines in El Paso Natural Gas Company's Snyder, Texas, gas booster station. Each unit is equipped to provide proper unloading to permit flexibility in meeting changing pressure conditions.



A compact 10-cylinder Cooper-Bessemer compressor operating at the Lone Star Gas Company's Scurry County plant. As in all Scurry County installations pictured here, efficient service with low maintenance is assured when you install Cooper-Bessemer.

by **Cooper-Bessemer**

MOUNT VERNON, OHIO AND GROVE CITY, PENNA.

Tulsa Shreveport St. Louis Los Angeles Chicago

THREE F.C.C. UNITS are used in refining operations by Cities Service Refining Corp. at its Lake Charles, La., refinery. Flexibility afforded by the three units and large capacity permit maximum production of high-quality products.

Here's new light on

What Makes a Good Cat Cracker Feed

Cities Service experimented with several at Lake Charles, with results as reported here

by E. C. Oden and J. J. Perry

WITH the expansion of catalytic cracking capacity feed stocks which have previously been borderline have assumed greater importance. Among these feed stocks are catalytic cracking cycle oils, lube-plant return stocks, cycle oils from thermal unit operations, and feed stocks obtained from treatment of oils from thermal units.

Catalytic cracking may be applied successfully to any of these stocks. About the only limiting factors are economics and catalyst-bed contamination.

- In general, virgin gas-oil feed stocks are the most desirable large-quantity feed stocks. They are, however, most apt to carry contaminants.
- Lube-plant extracts from which aromatic components have been removed (such as furfural extract) are below average in catalytic-cracking quality. However, paraffinic extracts such as waxes are excellent feed stocks.
- First-pass cycle stocks are good feed stocks, but their quality decreases rapidly as the number of passes increases.

Cracking facilities . . . The Lake Charles refinery of Cities Service Refining Corp. was designed to produce a part of the vast quantities of wartime aviation gasoline and to provide feed stock for a butadiene plant. Design crude throughput was 70,000 bbl. per calendar day. Main pieces of equipment were a propane-deasphalting unit, conventional atmospheric-pressure topping units, a combination thermal cracking and reforming unit, sulfuric-acid alkylation units, and three Model II fluid catalytic cracking units, each of 15,500 bbl. per day design throughput.

With the advent of peacetime operation and low-severity motor operation this 15,500-bbl. per day throughput became 40,000-plus bbl. per day. While the crude rate to the refinery was increased by a considerable amount, with this high ratio of catalytic-cracking capacity to crude run, it became possible to catalytically crack a large percentage of all material heavier than kerosine, and also to recycle a large percentage of the cycle oils produced.

Because of the need for catalytic-cracking feed stock, many stocks were cracked and experience gained in their use which would not have been possible at other refineries with proportionally less catalytic cracking capacity.

Nature of stocks . . . Complete analyses of these feed stocks are given in Table 1. Virgin light gas oil and virgin heavy gas oil are obtained by atmospheric crude distillation. Deasphalted gas oil is produced on a conventional propane deasphalting unit from crude residuum. Yields are also presented for the material resulting from propane deasphalting of tar from visbroken asphalt from the first propane-deasphalting step.

A lubricating-oil plant takes crude

(Continued on page 223)

TABLE 1—TYPICAL FEED-STOCK ANALYSES

Column number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
																DAGO from visbreaker	
Feed type—	VHGO	VLGO	DAGO	"A" HCS	"B" HCS	"C" HCS	"A" LCS	"B" LCS	Rerun bottoms	Furfural extract	Neutral distillate	Soft wax	Heavy int. dist.	Heavy int. Duo-Sol extract	Thermal G.O. from visbreaker B.S. extract	B.S. extract	Asphalt tar
Gravity, °A.P.I.	28.0	39.4	21.4	22.5	29.0	22.5	29.5	28.7	31.0	18.0	29.3	35.3	24.5	12.9	30.4	17.9	19.8
I.b.p., °F.	530	468	552	530	560	558	440	481	445	610	531	612	390	399	386	478	474
10 per cent	610	513	661	598	612	601	486	489	454	656	595	666	636		439	557	514
30 per cent	651	538		644	640	625	506	535	456		674	696			466	666	617
50 per cent	685	551		677	657	642	524	550	459						493		700
70 per cent		568			678	661	552	568	463						541		
90 per cent		604				686	607	595	471						653		
End point, °F.		680					688	635	523								
Per cent at 700° F.	59		21	65	85	95				25	48	33	23	8	95	42	50
Conradson carbon res., weight per cent	0.0	0.0	3.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0		0.2	2.5	0.0	3.5	3.3
Sulfur, weight per cent	0.2	0.3	0.5	0.9	0.6	0.7	0.4	0.4	0.6	0.5	0.3		0.4	0.8	0.4	0.7	0.6
Aniline point, °F.	183	166	209	156	171	160	127	137	88	150	222		219	185	122	148	142
Diesel index	50.5	59.6	44.7	35.1	49.6	36.0	37.5	39.3	27.4	27.0	65.0		53.7	20.4	37.1	26.5	28.1

TABLE 2—YIELDS—PERCENTAGE ON FEED

Column number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
																DAGO from visbreaker	
Feed type—	VHGO	VLGO	DAGO	"A" HCS	"B" HCS	"C" HCS	"A" LCS	"B" LCS	Rerun bottoms	Furfural extract	Neutral distillate	Soft wax	Heavy int. dist.	Heavy int. Duo-Sol extract	Thermal G.O. from visbreaker B.S. extract	B.S. extract	Asphalt tar
A. SEVERITY 1:																	
Coke, weight per cent	3.2	1.6	6.0	4.5	3.7	3.3	2.4	1.9	1.3	5.5	3.0	2.5	7.0	10.0	3.9	8.5	9.0
Dry gas, weight per cent	5.9	4.5	5.6	5.1	5.1	3.7	4.8	4.2	3.4	5.6	6.2	9.8	11.1	5.8	4.7	5.8	4.0
Propylene, volume per cent	4.8	3.3	3.5	3.2	3.2	2.4	3.8	3.4	2.7	1.7	5.2	10.2	4.6	3.0	3.9	4.2	3.4
Total B-B, volume per cent	10.9	8.2	7.6	9.6	10.0	7.2	8.4	7.4	6.8	9.3	12.1	22.0	9.7	8.9	7.2	6.8	6.9
Gasoline, volume per cent	34.1	25.6	47.8	27.4	27.4	20.0	22.5	21.0	22.6	36.9	46.0	52.0	54.0	41.0	23.0	27.4	26.0
Total B-B + gasoline	45.0	33.8	55.4	37.0	37.4	27.2	30.9	28.4	29.4	46.2	58.1	74.0	63.7	49.9	30.2	34.2	32.9
Light cycle stock, volume per cent	33.1	64.0	21.4	30.6	30.6	34.0	68.0	71.0	71.0	23.0	17.0	8.0	19.0	17.0	55.0	29.0	32.0
Heavy cycle stock, volume per cent	18.9	1.0	19.6	31.4	31.4	37.0	0	0	0	28.0	24.0	17.0	14.0	26.0	9.0	31.0	30.0
Conversion, volume per cent	48.0	35.0	59.0	38.0	38.0	29.0	32.0	29.0	29.0	49.0	59.0	75.0	67.0	57.0	36.0	40.0	38.0
Isobutane, volume per cent	4.7	3.8	2.5	4.3	4.3	3.0	4.1	3.5	2.7	3.1	3.9	7.5	1.7	2.3	3.0	1.3	1.6
n-Butane, volume per cent	1.0	0.8	1.1	1.3	1.3	0.8	0.7	0.6	0.6	1.0	1.0	1.8	1.3	1.2	0.7	1.0	0.7
Butylenes, volume per cent	5.2	4.6	4.0	4.0	4.4	3.4	3.6	3.3	3.5	5.2	7.2	12.7	6.7	5.4	3.5	4.5	3.6
B. SEVERITY 2:																	
Coke, weight per cent	1.8	0.8	4.9	2.9	2.1	2.6	1.1	0.9	0.6	2.7	2.0	1.8	5.0	7.8	1.9	6.0	5.8
Dry gas, weight per cent	4.4	2.7	4.3	3.4	3.4	2.1	2.8	2.3	2.0	3.8	4.7	9.1	5.4	4.0	2.7	3.8	2.5
Propylene, volume per cent	3.0	2.1	2.8	2.2	2.2	1.4	2.2	1.8	1.4	1.5	3.9	9.5	3.9	2.0	2.4	2.6	2.0
Total B-B, volume per cent	7.5	4.9	5.3	6.2	6.6	3.9	5.0	4.1	2.6	5.6	8.8	20.6	7.0	7.1	4.6	5.2	3.2
Gasoline, volume per cent	29.0	20.0	41.7	21.1	21.1	12.7	15.5	13.4	16.1	31.0	39.0	50.0	49.0	35.0	16.5	23.0	21.0
Total B-B + gasoline, volume per cent	36.5	24.9	47.0	27.3	27.7	16.6	20.5	17.5	18.6	38.6	47.8	70.6	56.0	42.1	21.1	28.2	24.2
Light cycle stock, volume per cent	37.9	73.4	23.7	34.8	34.8	38.0	79.0	82.0	82.0	25.0	20.0	9.0	23.0	20.0	65.0	30.0	37.0
Heavy cycle stock, volume per cent	25.1	2.6	28.3	38.2	38.2	44.0	0	0	0	37.0	32.0	26.0	19.0	34.0	10.0	36.0	36.0
Conversion, volume per cent	37.0	24.0	48.0	27.0	27.0	18.0	21.0	18.0	18.0	38.0	48.0	67.0	56.0	46.0	25.0	31.0	27.0
Isobutane, volume per cent	3.1	1.9	1.7	2.7	2.7	1.4	2.1	1.6	0.9	1.2	3.1	7.0	1.0	1.9	1.5	0.8	0.5
n-Butane, volume per cent	0.6	0.4	0.7	0.7	0.7	0.3	0.4	0.3	0.3	0.5	0.7	1.6	0.8	1.0	0.6	0.6	0.3
Butylenes, volume per cent	3.9	2.6	2.9	2.8	3.2	2.2	2.5	2.2	1.4	3.9	5.0	12.0	5.2	4.2	2.5	3.8	2.4

Note: 900° F. reactor temperature. 30 D+L catalyst activity (synthetic). 0.5 weight per cent carbon residue on catalyst.

Eastern States Petroleum Co.'s Houston refinery.

VISBREAKING . . . Still the Basic Process For Fuel Reduction

Eastern States here reports on some interesting innovations

by M. G. Boone and D. F. Ferguson

THE visbreaking process is used quite extensively for reducing fuel-oil yields, and the resulting know-how of operation and maintenance is of considerable interest to all refiners. Eastern States Petroleum Co. engineers have developed and adapted various innovations to facilitate high-severity cracking conditions while maintaining a high service factor of operations.

The material balance and the utility costs of this process are outlined in Table 2. The quality of products is shown in Table 1.

Charge . . . The charge to the visbreaker unit is prepared in a vacuum flashing unit operated at approximately 27 in. of vacuum, and is preheated to a temperature of 700°-710° F. A schematic flow diagram of the unit is shown in Fig. 1. Each cracking furnace is charged by an individual pump on flow control. Water is injected immediately prior to entry into each furnace and is controlled to give a constant velocity through the tubes. An example of the curve established to give maximum results for this particular unit is shown in Fig. 2.

The flow of oil in the upshot-type heaters is through the convection sections and then down the radiant section to the outlet of the furnace. Transfer valves on the outlet of the furnaces remain open during the visbreaking op-

Authors are with Eastern States Petroleum Co., Houston. Boone is assistant manager, and Ferguson is process engineer.

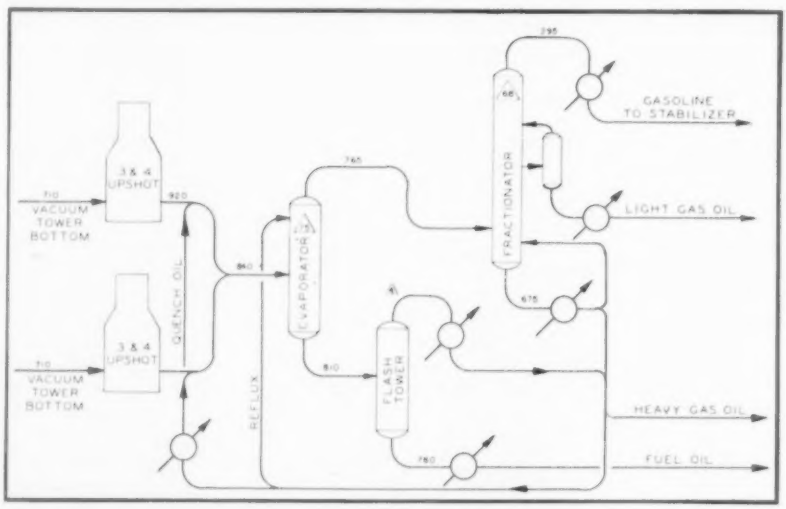


Fig. 1—Schematic flow diagram of visbreaker unit.

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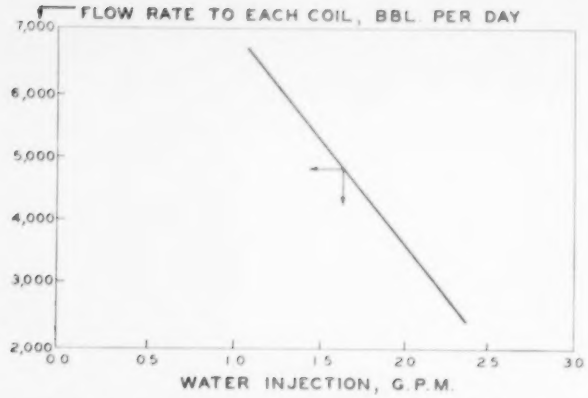

Fig. 2—Variation of water injection with flow rate of oil charge.

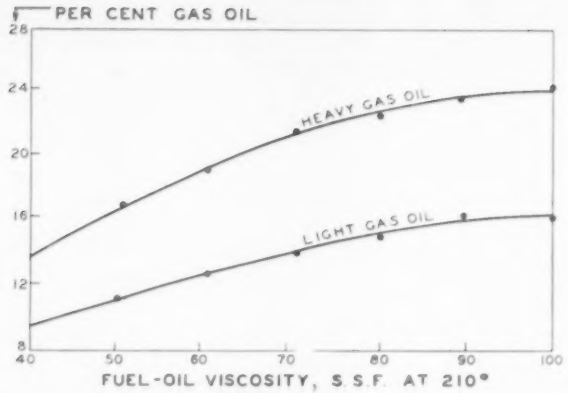

Fig. 3—The quantity of light gas oil and heavy gas oil to blend the fuel oil to a 300 S.s.F. at 122° F.

eration, which means that the furnace pressure floats on the 75 psig. evaporator.

Outlet temperatures are controlled at 920° F. The heavy-gas-oil quench is injected into transfer lines through the body of the transfer valves located immediately after the furnace outlet. This gas oil helps keep these valves swept clean of coke, and is controlled to give a bottom temperature to the evaporator of 810° F.

Heavy gas-oil reflux is added to the top of the evaporator to give a vapor outlet temperature of 765° F. These temperatures were established for this particular operation to give minimum carryover of residue to the fractionator and to prevent coking in the transfer lines. Levels in the evaporator are maintained at a minimum to decrease coke laydown in the bottom of the evaporator. Two drawoffs are provided on the evaporator; one on the bottom and the other on the side.

Coke formation . . . At the start of a run, residue is withdrawn at the bottom and is continued until coke formation prevents transfer to the flash tower. When this occurs, the side draw is utilized while an attempt is made to reopen the bottom draw with a high-pressure ram system. This system consists of a high-head positive-displacement pump ramming fuel oil or gas oil back into the evaporator through the plugged drawoff. If this operation is successful, the bottom drawoff is immediately utilized; otherwise, the side draw is used to complete the run. Since installation of the side drawoff and the ram system, a shutdown due to a plugged drawoff has not been experienced.

The residue from the evaporator is pressured into an atmospheric flash tower where additional heavy gas oil is flashed from the final visbreaking fuel.

Gas oil is injected into the fuel oil

on the outlet of the flash tower to give a much lower viscosity oil, which means higher heat-transfer coefficients in the fuel coolers and much easier transferring of the oil. The quantity of gas oil to be added can be estimated from the chart shown in Fig. 3. Maintenance costs have decreased and longer service factors of the fuel coolers have been realized since the change to this viscosity-blending operation.

The overhead from the evaporator is pressured vapor phase into the fractionator where a 300°-end-point gasoline is taken overhead, a 650°-end-point gas oil is taken out through a side stripper, and a heavy gas oil is taken from the bottom. The gasoline

(Continued on page 211)

TABLE 2—VISBREAKING FOR FUEL OIL REDUCTION

Charge—	B/D
Vacuum tower bottoms	16,240
Yields—	B/D
L.P.G. butane	320
Motor gasoline	1,585
Heating oil	1,511
Cat cracker charge	1,280
Blended fuel oil	11,394
Total	16,090
Operating costs—	
Operating labor:	
1 Stillman at 2.56	$61.44
2 Asst. stillmen at 2.37	113.76
1 Fireman at 2.13	51.12
Total operating labor	$226.32
Maintenance labor	$340.00
Maintenance material	510.00
Utility costs:	
Cooling water, 3,000 g.p.m. at 5c/1,000	21.60
Steam, 40,000 lb./hour at 30c/1,000 lb.	288.00
Fuel gas, 3 M.M.c.f. at 13c/M.	390.00
Employe benefits	90.00
Supervision and other indirect costs	283.00
Total operating costs	$2,148.92

TABLE 1—LABORATORY INSPECTIONS

	Visbreaker charge	Stabilized gasoline	Light gas oil	Heavy gas oil	Fuel oil
Gravity, °A.P.I.	11.2	73.6	38.9	24.1	7.0
Flash, P.M.	200+		105	152	200+
S.s.F. at 210°	99				89
R.v.p.		7.6			
Research octane base		73.2			
Research octane at 3 cc.		83.1			
Sulfur	3.23	0.34	1.39	1.86	3.51
Conradson carbon	13.11			0.21	21.25
Sediment by ex'n	0.019				0.56
Diesel index			50.2	41.9	
Per cent asphalt	62				
Distillation:					
I.b.p.	414	111	290	434	
10 per cent	642	134	322	598	
20 per cent	686	140	354	672	
30 per cent	705	146	387	705	
40 per cent	723	153	435	725	
50 per cent	732	163	480	738	
60 per cent		175	519	750	
70 per cent		190	548		
80 per cent		212	572		
90 per cent		247	600		
E.p.		293	658		

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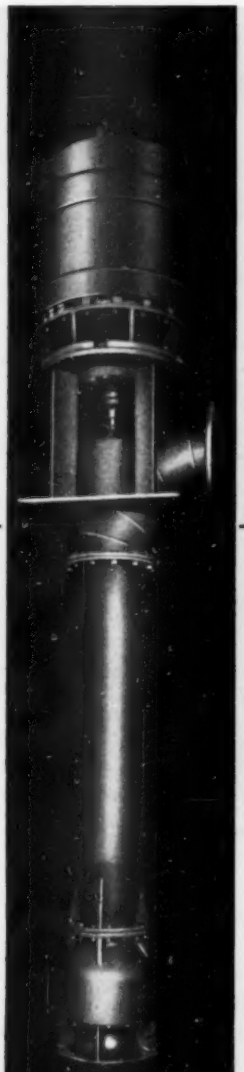

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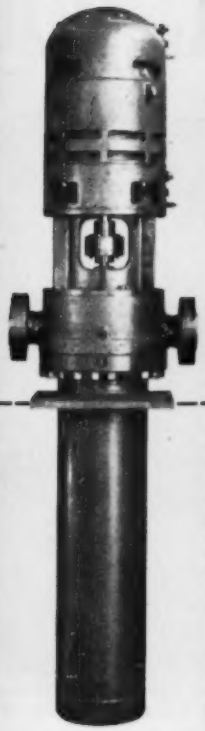

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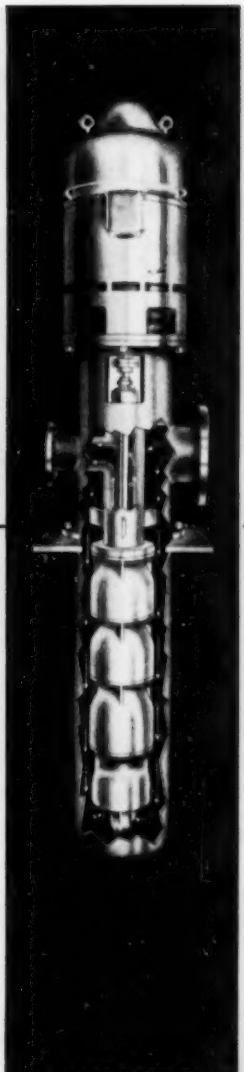

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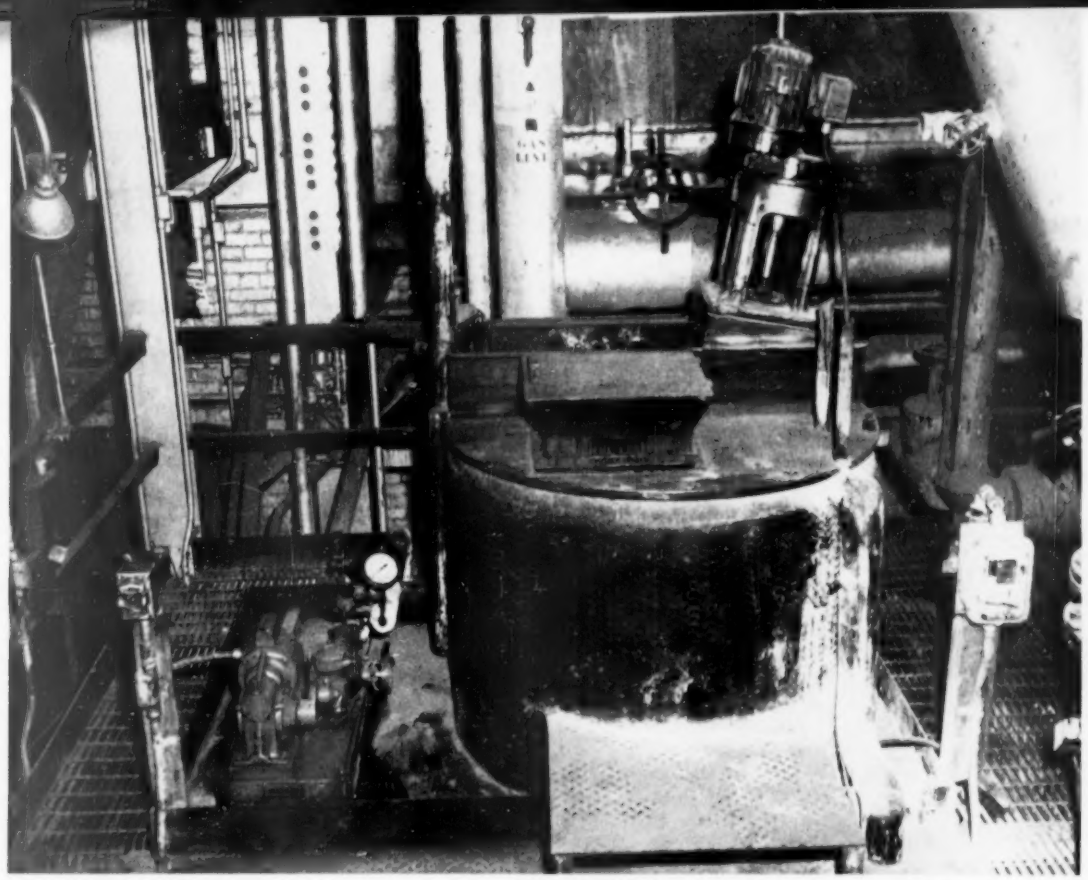


One of three identical fuel-oil additive systems serving three steam boilers. The additive batch is made up in the slurrying tank equipped with an agitator, and is introduced to the fuel in controlled amounts by the proportioning slurry charge pump shown at left.

MORE FROM

Additives in Residual Fuels Reduce Ash Deposits on Steam-Boiler Parts

by O. F. Campbell

This review of results obtained from the use of various additives in residual fuel oil for high-temperature steam generation was presented at a panel discussion on "Residual Fuel Oils for Gas Turbines" conducted by the American Society of Mechanical Engineers, December 1, 1953, in New York. The author offered this information to point to a possible means for making residual fuels more adaptable for gas-turbine work. The results of Sinclair's experience should also prove of interest to other refiners who are using or planning to use heavy fuel for steam plant use.

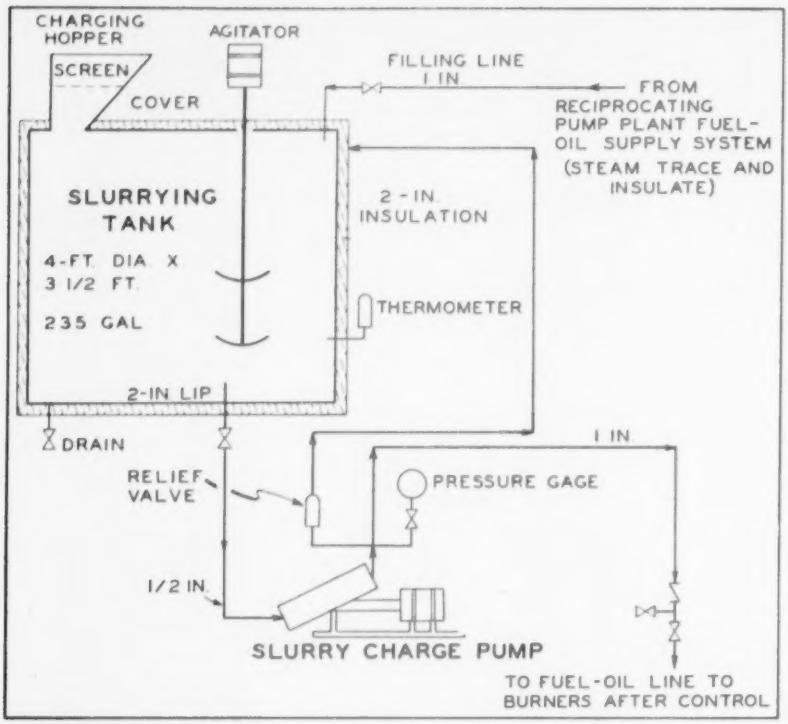
WHEN burning residual fuel oil for 900-psig. 900° F. steam boilers, there is an appreciable quantity of fuel-oil ash deposited on both boiler and steam superheating tubes with the greatest deposit on the steam superheating tubes. Although the fuel-oil ash quantity is exceptionally low, it is very troublesome due to the fact that it tenaciously sticks to the tubes and cannot be removed by conventional soot blowers. The ash deposit on the superheater tubes is semifluid and accumulates to the extent that within a few weeks the superheater tube bank becomes plugged with ash deposit and the boiler must be shut down or the tubes washed with water during reduced operation.

The author is associated with Sinclair Refining Co., East Chicago, Ind.

Sinclair's first attempt to use an additive to condition the ash for ease of removal or a reduction of ash deposit was in 1951 when we used barium sulfonate. This was not noticeably effective and from subsequent experiences we believe that the reason why this compound was not effective was that we did not use enough of it. We were limited in supply of this material and hampered by the high price.

When we observed the use of dolomitic lime on some boilers in Florida, we immediately started making preparations for the use of dolomitic lime on three 900-psig. 900° F., 250,000-lb. per hour boilers at our East Chicago refinery where we were having serious slagging difficulties. We started the use of dolomitic lime in March 1952 with the following results:

1. The ash deposit was no longer sticky in nature, but powdery and easily removed by hand lancing with air or



System used by Sinclair Refining Co. at East Chicago refinery for introducing controlled proportions of batched additive slurry to heavy-fuel lines for high-temperature steam generators. In this system, none of the additive is allowed to return to the fuel-oil storage tank.

steam or with retractable steam soot blowers.

2. The ash deposit, although as heavy as before the use of the lime, was of the dry, powdery type and also included some "moss like" structure. The spongy moss-like structure of the ash made it easy to remove by conventional soot blowers. The quantity of dolomitic lime used was approximately 1 lb. of lime per pound of ash in the fuel. If less than this amount, the ash had sticking tendencies and if more, the ash deposit was excessive and more difficult to remove.

3. The normal corrosion of air heaters and ducts was materially reduced by the use of dolomitic lime.

It is felt that the magnesium oxide content of the dolomitic lime was the primary cause of the change in nature of the ash deposit and we then tried Additive X-223 as sold by National Aluminate Corp. This compound contains for the greater part magnesium oxide accompanied by a combustion accelerator. This compound was equally as effective as dolomitic lime and only required about one-fourth of the quantity. This compound produced excellent results with minimum deposits on water wall tubes and by the correct use of soot blowers the superheater tubes could be kept clean.

Subsequent to the use of compound X-223, we used straight magnesium oxide in the ratio of 1:1 of oil ash and MgO. This compound worked substantially the same as X-223, and we eventually reduced the quantity of MgO to ½ lb. of MgO to 1 lb. of oil ash. The straight MgO, however, did not work quite as well as X-223.

Following this trial of straight MgO, we tried a mixture of 98 per cent magnesium oxide and 2 per cent copper chloride. This additive was also very effective and we finally reached a dosage of ¼ lb. of this mixture per pound of fuel-oil ash.

Each of the above-mentioned compounds was fed to the boiler in a slurry form. We installed a small tank and a small plunger-type proportioning pump and mixed up the additive with heavy fuel oil. This slurry of oil and additive was fed directly into the fuel line immediately preceding the burners and none of the additive was allowed to return to the fuel-oil storage tank. With three separate additive feeding devices we could use three different additives at one time and obtain what was felt to be comparative results. It appears that the additive changes the nature of the oil ash slag so that the ash deposit on the boiler tubes could be easily removed by mechanical means. The additive apparently changed the fusion point of the ash and conditioned the ash in some manner so that the ash from the fuel oil was substantially nontroublesome.

To the writer it appears that a similar procedure may be applied to heavy fuel oil when burned in a gas turbine. Caution should be exercised to be certain that the fuel-oil additive in the slurry form does not plug up or foul fuel-oil burners. It is the author's understanding that automatic dry-lime feeders are now available so that dry, powdery additives can be fed to the air stream with equal effectiveness as when fed in slurry form.

A challenge is therefore presented to the gas-turbine manufacturers to provide at the point of consumption an additive plus proportional feeding equipment that will provide trouble-free gas-turbine operation with any kind of heavy fuel oil regardless of source or quality or price. The boiler manufacturer can and has done it and it is hoped that the manufacturers of gas turbines will accept a similar challenge.

Furfural Refining Scores On Four Counts

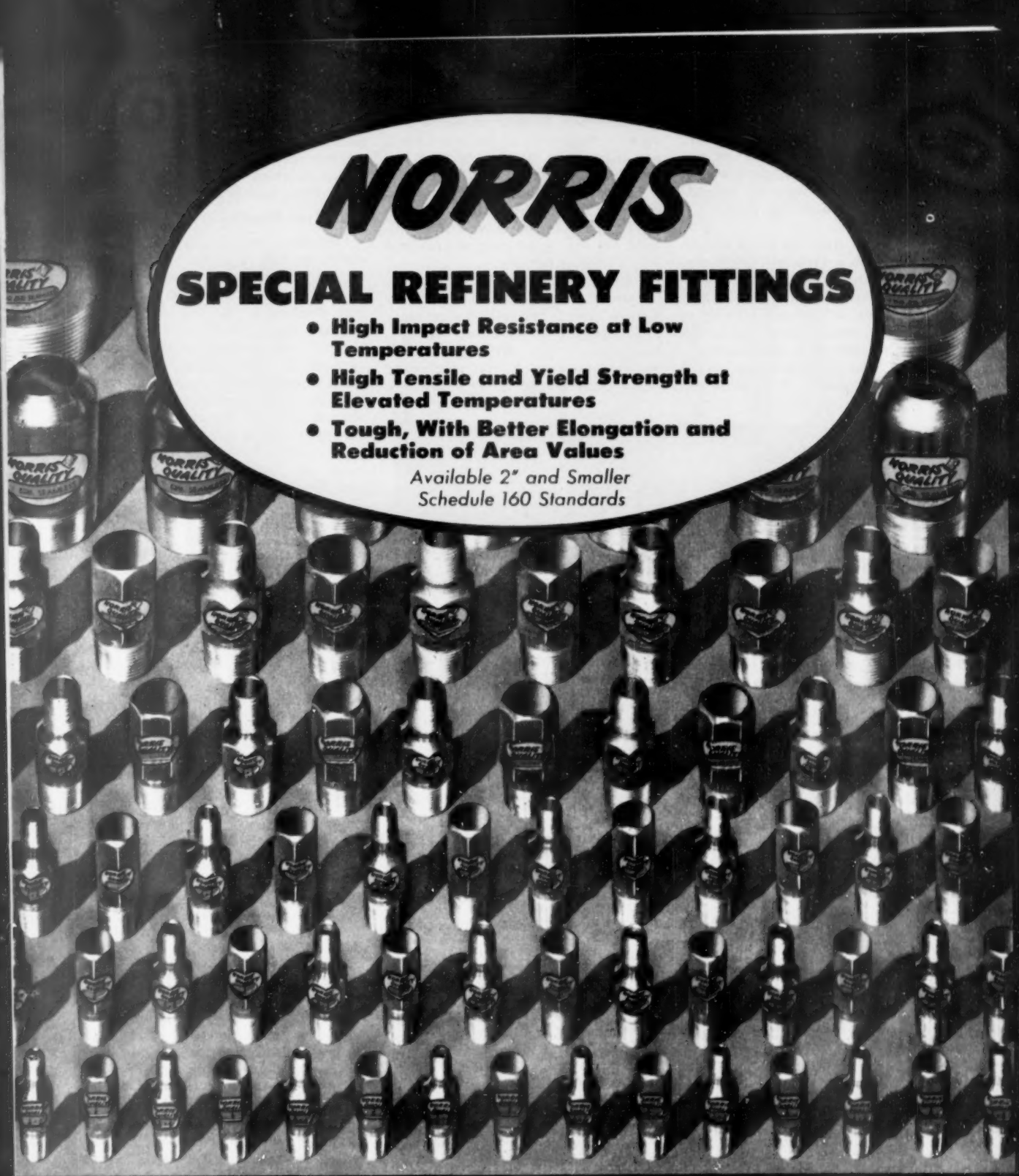
(Continued from page 161)

The soluble oil content of the circulating solvent stream normally reaches an equilibrium value below about 5 volume per cent with the A fractionator not in operation. This quantity of soluble oil is not significantly detrimental to the operation. Consequently, the A fractionator normally is not operated.

Refining light cycle oils . . . The data presented in Table 1 illustrate the relationship between yield and quality of refined oil obtained from a light catalytic cycle gas oil. The cycle oil charged to the furfural unit during these runs was produced in the catalytic cracking of mixed Arabian-Venezuelan virgin gas oils at a conversion level of approximately 55 volume per cent. The quality of the refined oil as related to process yield is shown in Figs. 2, 3, and 4.

The data illustrate the high yield of raffinate having low sulfur content and high cetane rating that can be recovered by furfural refining high-sulfur-content cycle oils.

Refining virgin distillates . . . Table 2 presents the data obtained from a series of plant runs made while charging a virgin distillate recovered from mixed Arabian-Venezuelan crudes. Virgin distillates recovered from these crudes are normally included in catalytic cracking charge stock as their high sulfur content makes them unsuitable for



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use as diesel fuel or household heating oil. As shown in Table 2, however, extremely high-quality refined oils can be obtained from such virgin stocks.

Figs. 4, 5, and 6 show the refined-oil quality as a function of yield.

Refining mixed cycle oils . . . The light cycle gas oil in a variable combination with the heavy cycle gas oil produced from the Eagle Point fluid catalytic cracking unit is furfural refined to produce additional charge stock for the fluid cracking unit. Depending upon the volume of light cycle gas oil and upon the quality of the cycle oils produced from the fluid catalytic cracking unit, the gravity of the mixed cycle oils charged to the furfural unit has varied from about 18° to 28° A.P.I.

Tables 3 and 4 present data obtained in plant runs on two mixtures of cycle oils representative of those furfural refined for the preparation of cracking-unit charge stock.

Figs. 2 and 3 present the relations between product yield and quality. As will be noted, the high-boiling-range cycle oils produce an extract having a comparatively low A.P.I. gravity. Of some significance in the refining of heavy cycle gas oil is the removal of the heavy metals found in the cycle oil. Analyses have shown that furfural refining removes essentially all of the vanadium which may be present in the Eagle Point heavy cycle oil.

Catalytic Cracking of Refined Oils

Laboratory investigations have demonstrated that catalytic cracking of furfural refined cycle oil will produce a product distribution comparable to that obtained in the cracking of the original virgin oil of similar boiling range.[1,2] A similar comparison was obtained in plant operations at Eagle Point wherein the fluid catalytic cracking unit was operated alternately on refined cycle gas oil and on a virgin oil from mixed Arabian-Venezuelan crudes similar to that from which the cycle oil had been produced. The cracking unit operating conditions, as shown in Table 5, were maintained essentially constant for both feed stocks.

The two cracking-unit charge stocks are compared in Table 6. The refined oil, produced from comparatively low-gravity cycle oils at low solvent dosages on the furfural unit, contained notably less sulfur, nitrogen, and carbon residue than the virgin feed stock. The refined oil had a somewhat lower and narrower boiling range with a correspondingly higher A.P.I. gravity.

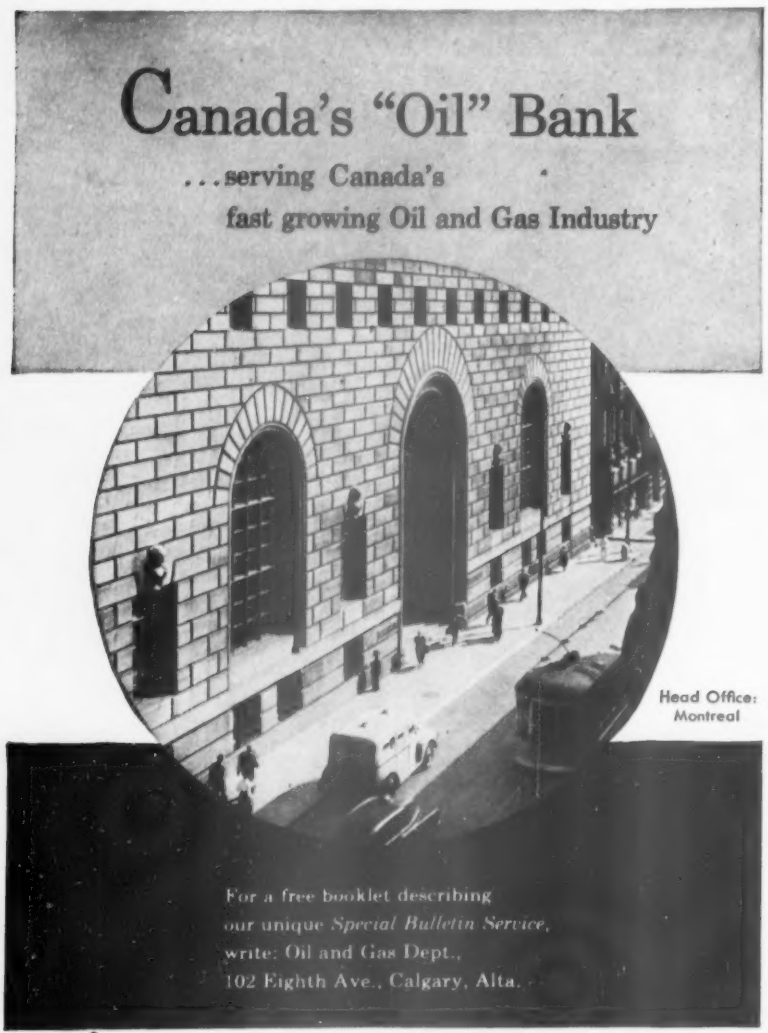
The results obtained from catalytically cracking the two feed stocks in the Eagle Point fluid catalytic cracking unit are compared in Table 7. Under similar severity conditions, the lighter furfural refined cycle gas oil, as expected, underwent somewhat less conversion but produced an equal total butane retention gasoline yield. The furfural-refined cycle gas oil produced more butane and less dry gas than the virgin gas oil.

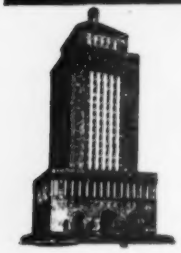
Table 8 presents a comparison of the debutanized gasolines and light cycle gas oils produced from the two feed stocks. As indicated, the sulfur compounds in refined oil are considerably more refractory than those in virgin oil so that less of the sulfur contained in the refined oil charge is to be found in the gasoline product. This characteristic of refined oil, in combination with the low sulfur content of refined oil, results in the gasoline product having a low sulfur content. The gasoline from refined oil is observed to have a higher octane rating and a lower average boiling point, the difference in average boiling point.

References

1 Gross, H. H., Skelton, W. E. and Best, J. C.—"Furfural Refines Gas Oil". The Oil and Gas Journal, March 23, 1950, page 211.

2 Gee, W. P., Gross, H. H. and Skelton, W. E. "Furfural Extraction of Middle Distillates". Paper presented at The Third World Petroleum Congress, The Hague, 1951.





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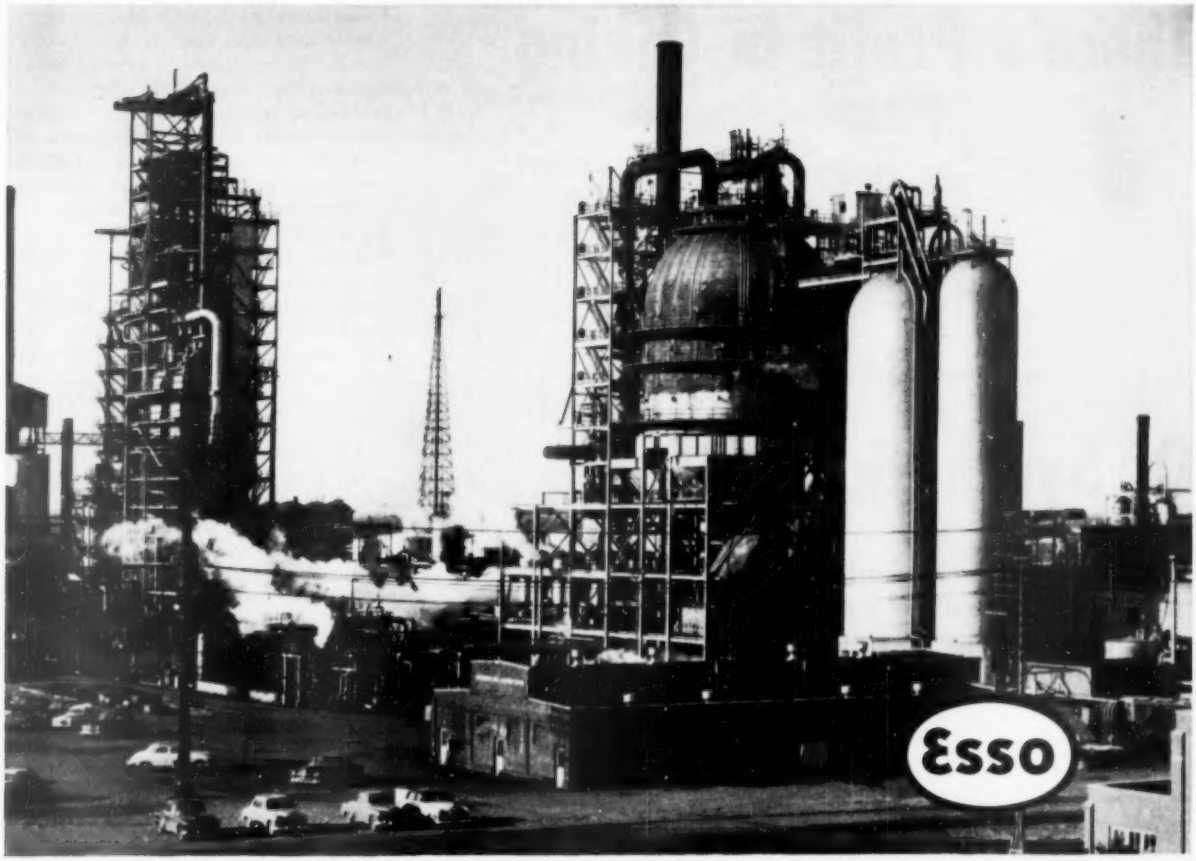

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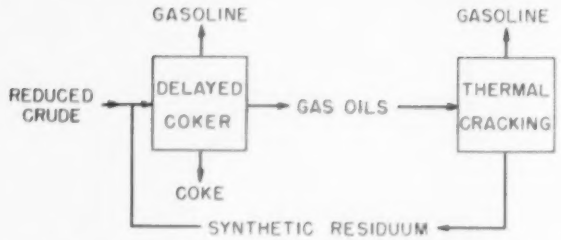


Fig. 1—Simplified flow sheet for coking synthetic residuum.

Of Synthetic Residua

. . . particularly to refineries having an exceess of thermal cracking capacity who are in a position to convert all resid stocks into gasoline and coke.

by John L. Chadwick

RESIDUAL fuels are the cheapest refinery products, being sold at prices considerably below the cost of crude oil. Conversion of residual oils to the more valuable materials is, therefore, a major refinery problem. The method employed for solving it is of importance in making operations profitable.

Omitting hydrogenation, which few refineries are using, coking is the most effective method for eliminating refinery residuum by converting it into coke and light distillates. The gas-oil fractions are utilized as distillate fuel oils commanding a fair price or as charging stocks to cracking units.

Petroleum coke, formerly little used by industry, can be sold now at attractive prices if it meets quality standards.[1] The coke produced from cracked residua is superior to that obtained from the virgin stocks and finds an easy market. Table 1 compares characteristics of coke secured from virgin stocks and from 70/30 blends of virgin stocks with thermal synthetic residua.

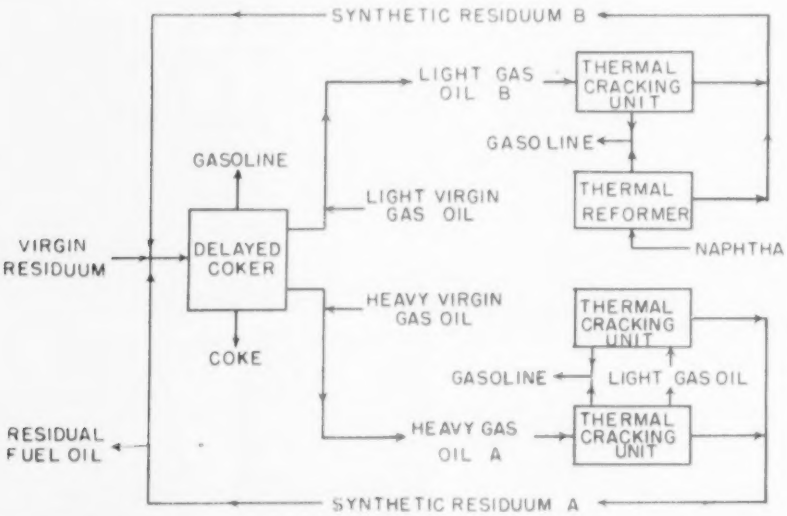


Fig. 2—Typical flow sheet of a delayed coker installation processing synthetic residua.

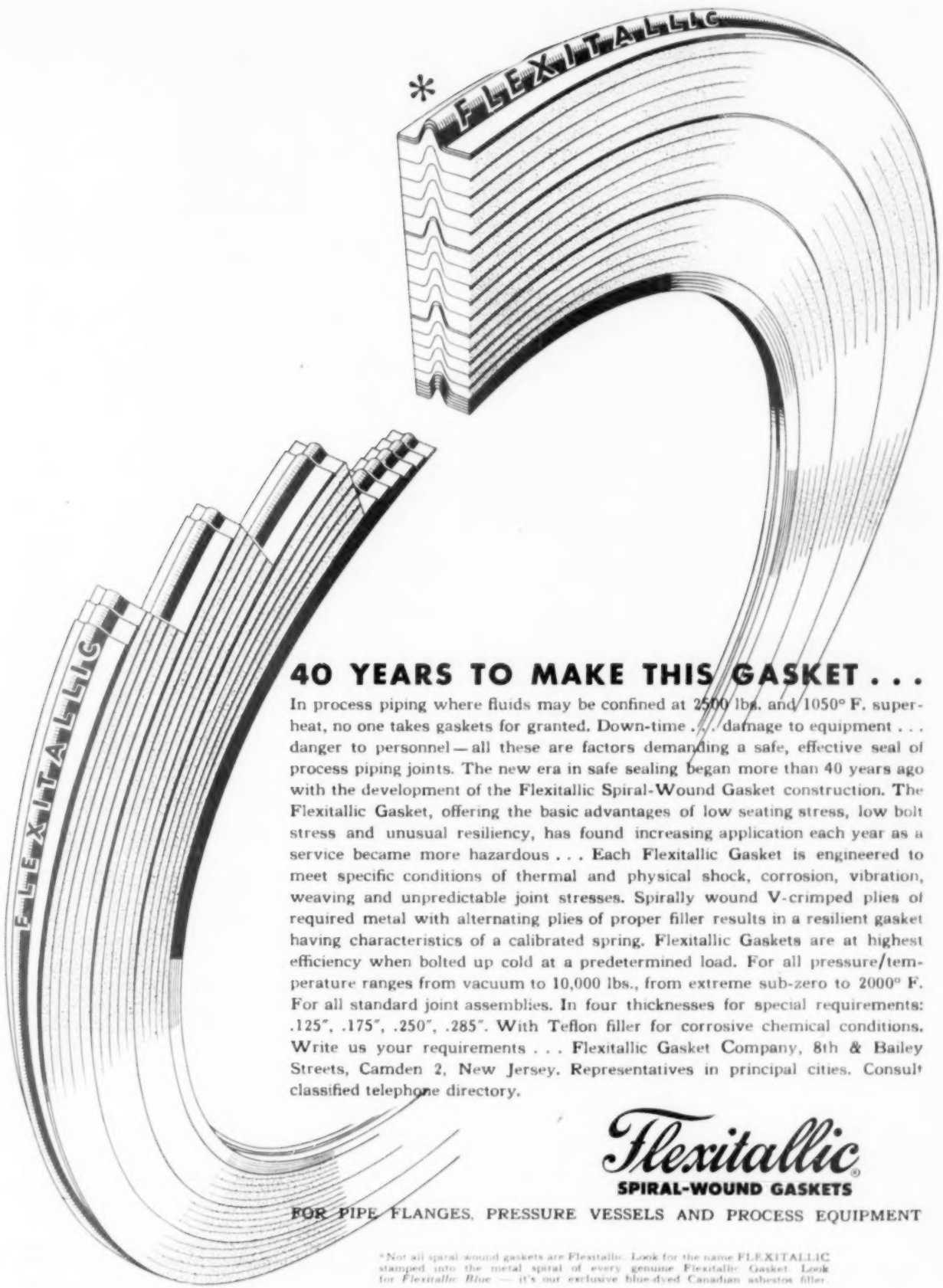
Coker furnace . . . In the past, refineries were reluctant to coke cracked residua because of the danger of forming heavy carbonaceous deposits in the furnace tubes and transfer lines. Our experiences showed that direct injection of synthetic residua to the coker furnace reduces the quantity of crude formation as compared to the use of straight virgin stocks. The coker furnace is fed from the bottom of the bubble tower to which the reduced crude is charged. The vaporized fractions from the coke drum are also charged to the tower. The synthetic residua are combined with the bubble-tower bottoms in the suction line of the coker-furnace charge pump.

The cracked residua are injected directly from the cracking units without intermediate storage or cooling. This is an important variation from previous attempts at cracking synthetic residua. Proper instrumentation is necessary to effect good control of the delayed-coking operations. The quantity of cracked residua injected is measured and carefully adjusted in order to avoid fluctuations in the rate of coke production.

Coking of synthetic residua is particularly attractive to the refineries having an excess of thermal cracking capacity. Such refineries are in a position to convert all the residual stocks into gasoline and coke. A simplified example of these operations is shown in Fig. 1. Synthetic residuum produced in thermal treatment of distillates is combined with virgin residuum from the distillation units. This blend is charged to the delayed coker. The gas oils produced in the coking operation are charged to cracking coils.

The flow sheet shows that the residual oils are thus recycled to extinction. However, this is not necessary if the demand for certain quantities of residual fuels must be met by the refinery. Under these conditions the desired quantity of residual fuel is withdrawn from the system depending on the market demand. An example of such operations is presented in Fig. 2. The coker gas oil is split into light and heavy fractions which are combined with virgin gas oils and charged to the corresponding cracking coils. The light gas oil produced in the heavy-gas-oil cracker is charged to a separate coil. The residuum produced in thermal reforming of naphthas and the residua from the three crackers are charged to the delayed coker.

The properties of the residual streams are shown in Table 2. The coker charge is composed of 70 per cent virgin residua, 15 per cent residuum B, and 15 per cent residuum A. Approximate-



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John L. Chadwick is a chemical engineer in the Beaumont, Tex., refinery of Magnolia Petroleum Co. He graduated from University of Texas in 1949, with the degree of B.S. in chemical engineering. Chadwick is presently attending Lamar State College of Technology at night, taking courses in additional engineering subjects.

ly 60 per cent of residuum A is withdrawn for fuel-oil sales. This stock is selected for sales because it is the least desirable as coker feed. Variations in the above processing scheme may be needed for the individual refineries. For instance in some refineries the coker and virgin gas oils are cracked in catalytic units. The light and heavy catalytic cycle stocks are charged to thermal cracking units.

The synthetic residuum produced in this operation might be processed in the same manner as shown. The coker-unit temperatures are not affected by the presence of synthetic residua in blend with the virgin residua but the cycle time of the coker is reduced because of increased production of coke. The quantity of heavy gas oil circulated through the coker is also reduced on account of the limited capacity in the coke drums.

Gasoline yield . . . The yield of low-octane coker gasoline from the synthetic residua is very low compared to that from virgin stocks.[2] A correspond-

TABLE 1—PETROLEUM COKE ANALYSIS

Inspection—	Coke*	Coke†
Volatile matter, wt. %	11.5	10.0
Sulfur, wt. %	1.7	1.4
Ash, wt. %	0.5	0.4
Salt, wt. %	0.15	0.10

*Coke from virgin residuum. †Coke from a 30/70 blend of synthetic and virgin residua.

TABLE 2—PROPERTIES OF RESIDUA CHARGED TO DELAYED COKER

	Synthetic residuum		
Inspection—	A*	B*	Virgin residuum
Gravity, °A.P.I.	6.0	13.5	15.7
CCR, wt. %	9.0	5.0	5.0
Distillation, % at 700° F.	30	50	25
Vis., S.s.F. at 122°	18	25	40
Pour, °F.	5	5	50

*Residuum A produced in thermal cracking of light and heavy gas oils. Residuum B produced in thermal cracking of light gas oil and in thermal reforming of naphthas.

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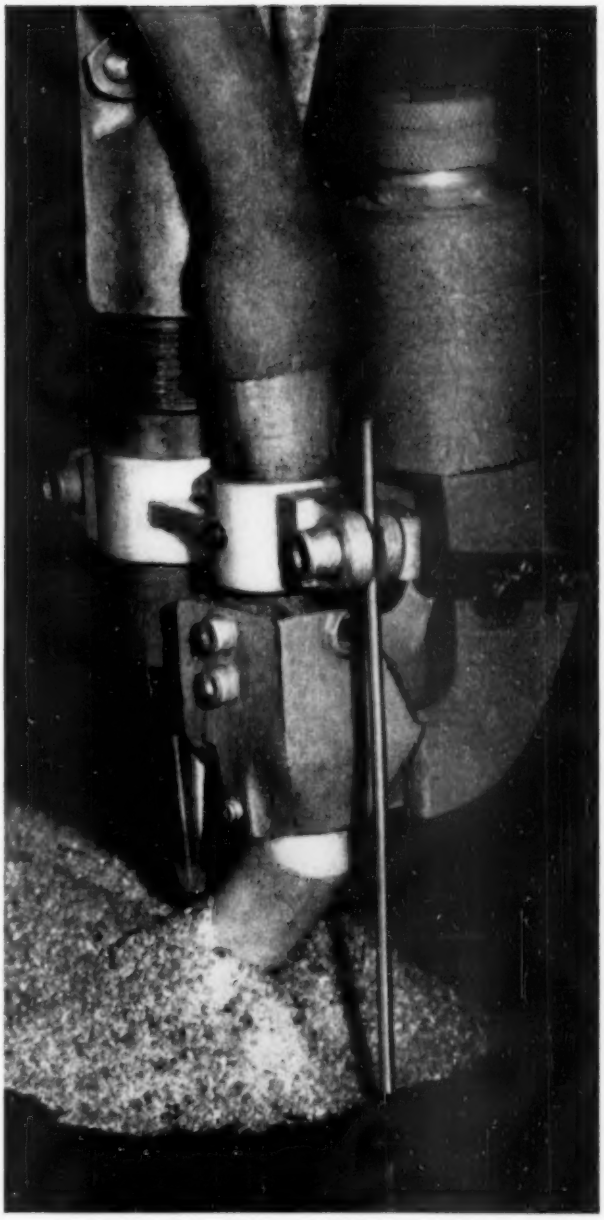

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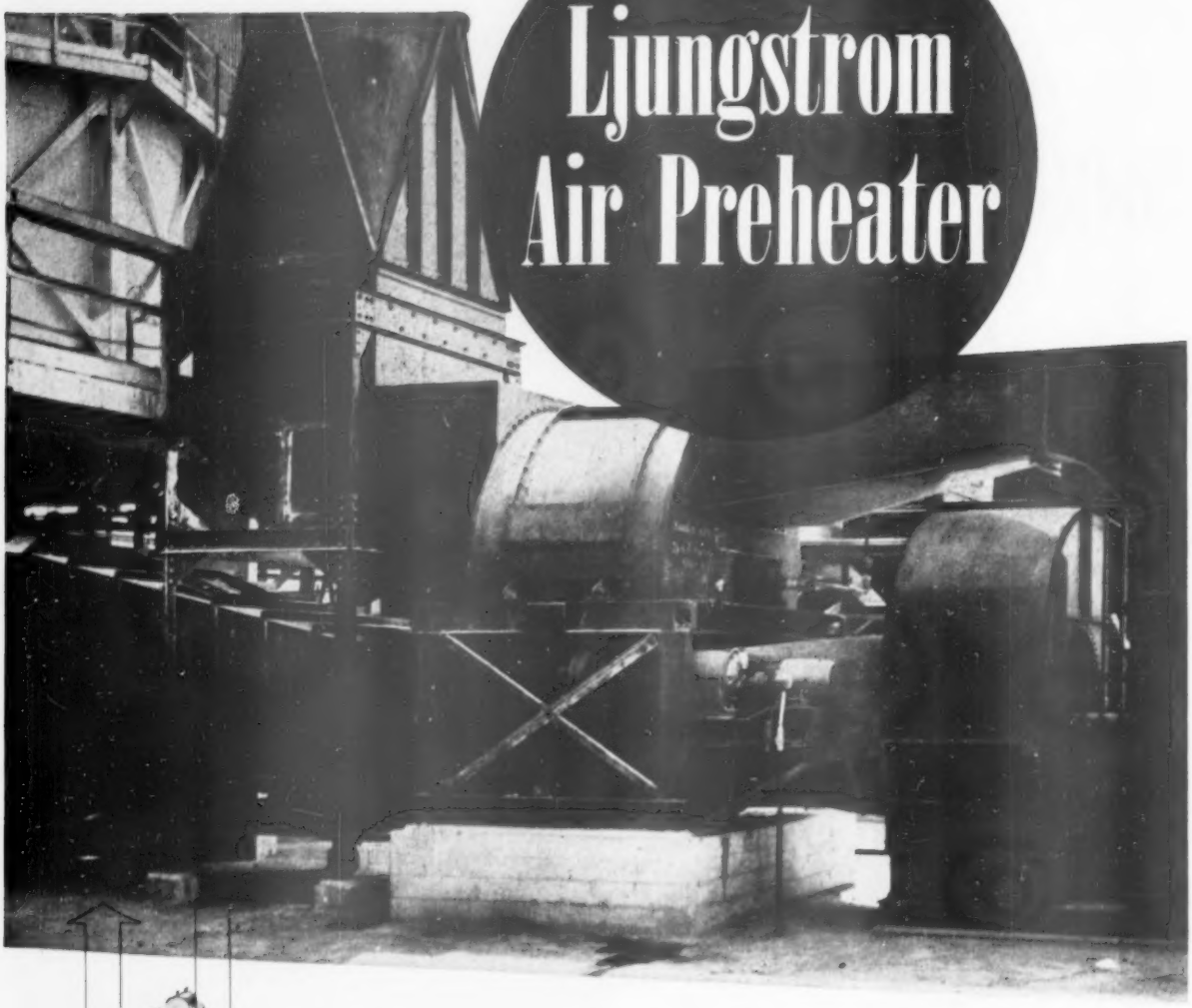

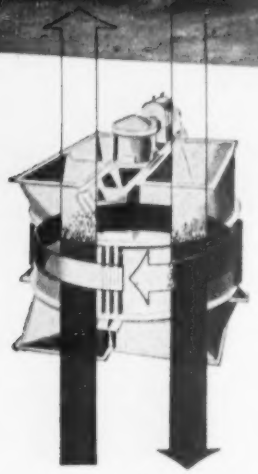

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TABLE 3—PRODUCTS OBTAINED FROM THERMAL CRACKING AND COKING OF CRUDE OIL

Products—	Coking*	Coking†
Motor gasoline, vol. %	64.5	68.5
Octane, res. +3 cc. TEL	85.5	86.5
Residual fuel oil, vol. %	15.0	9.0
Coke, wt. %	8.0	10.0

*Coking virgin residuum. †Coking a 30/70 blend of synthetic and virgin residua.

TABLE 4—U.O.P. CHARACTERIZATION FACTORS OF CHARGE STOCKS TO CRACKING FURNACES

Furnace charge stock—	Coking*	Coking†
Light gas oil A	10.5	10.3
Heavy gas oil A	10.6	10.4
Light gas oil B	11.2	10.8

*Coking virgin residuum. †Coking a 30/70 blend of synthetic and virgin residua.

ing high yield of coker gas oil is obtained. This gas oil is very desirable cracking stock. Although high temperatures must be employed in thermal cracking units, the resulting gasoline has an improved octane number as

shown in Table 3. In processing these materials no increase in carbonaceous deposits in the cracking furnaces has been observed when the temperature was raised 8° F. above that maintained on the former stocks.

Data obtained in commercial installations employing the described operation technique are shown in Tables 3 and 4. They refer to the yield of products from crude oil and to the quality of gas oils obtained before and after the recycling of cracked residua was established. In this instance the blend charged to the coker was 30 per cent synthetic residuum while the yield of residual fuel oil was kept at 9 per cent on the crude-oil charge.

Acknowledgment

The author wishes to express his appreciation to Magnolia Petroleum Co. for permission to publish this article and to V. A. Kalichevsky for his helpful suggestions and criticisms.

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1. Anon., Petroleum Processing 7, 351-2 (1952).
2. Garwin, L., and Steinkuhler, B. E., Ind. Eng. Chem. 43, 2586-92 (1951).

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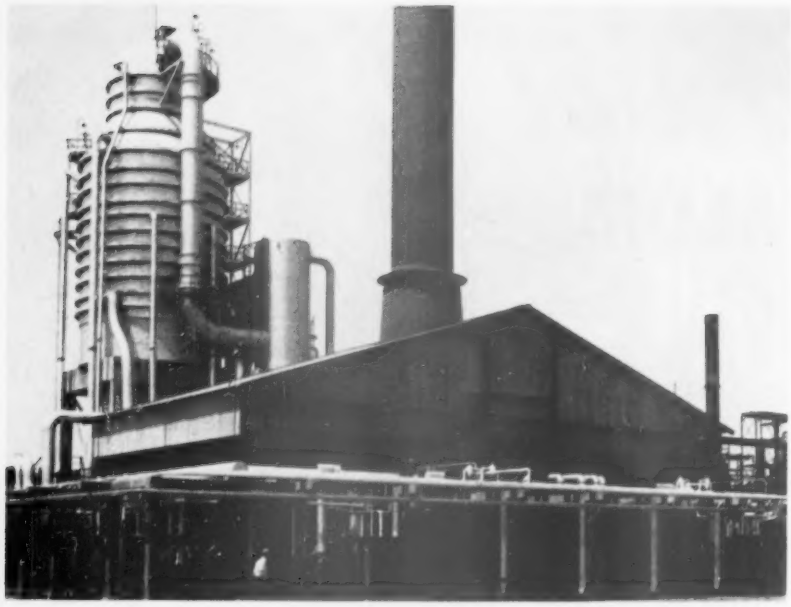


This pipe still at Esso's Bayway refinery is one of several which are fueled with high-viscosity thermal tar bottoms from visbreaking operations.

Utilization of High-Viscosity Thermal Tar as Refinery Fuel

Successful use of visbreaker bottoms for firing pipe stills and boilers permits Esso Standard Oil Co. to release added distillate-fuel fraction to markets.

by George Weber
Refining Editor

THE relatively low market for No. 6 fuel oil has prompted many refineries to use more of this heavy fraction for plant fuel. A further advantage can be gained from firing furnaces and boilers with hot high-viscosity residual fractions which would require the use of good-quality distillates for fluxing to No. 6 specifications. No. 6 fuel consumption is then restricted to that in which the available low value or difficultly processed distillates are used as the low-viscosity component.

Esso Standard Oil Co. is one of several companies which have been successful in utilizing such heavy residual fractions for internal consumption. At the Bayway refinery, Linden, N. J., an existing high-viscosity fuel system is now being expanded and improved in light of operating experiences gained in the burning of heavy thermal tars.

The economics of this practice may be illustrated by the simplified examples outlined in Table 1. A hypothetical refinery is assumed to be producing 10,000 bbl. per day of short residuum,

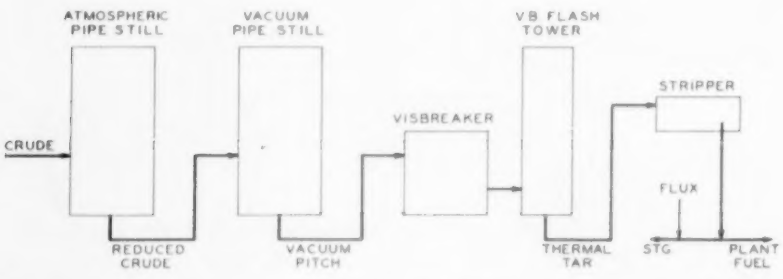
either asphalt pitch or thermal tar. Plant fuel requirements amount to the equivalent of 6,000 bbl. per day of this type of fuel. The heavy fractions requirements require a 50 per cent blend of low-viscosity component to meet No. 6 specifications. Two thousand barrels per day of low-value distillates are available as basic fluxing stocks. Any additional requirement must be met with good-quality salable distillates.

TABLE 1—HIGH VISCOSITY FUEL VS. NO. 6 FUEL OIL FOR REFINERY PLANT FUEL REQUIREMENTS

(Bbl./Day)

Case No. 1 **Utilizing No. 6 Fuel Oil**		
Heavy residual production		10,000
Flux required:		
Low value distillates available	(2,000)	
Good quality distillate	(3,000)	5,000
Total No. 6 fuel-oil production		15,000
Less plant fuel requirements		6,000
No. 6 fuel oil to market		9,000
Case No. 2 **Utilizing High-Viscosity Fuel**		
Heavy residual production		10,000
Less plant fuel requirements		6,000
Remaining residual		4,000
Flux required:		
Low-value distillates available	(2,000)	
Good-quality distillate	(0)	2,000
No. 6 fuel oil to market		6,000
Good-quality distillate released to market		3,000

In this possible oversimplified example, the switch from No. 6 to high-viscosity fuel for internal consumption has the direct effect of upgrading 3,000 bbl. per day of No. 6 fuel oil to salable distillates by releasing this volume of



Schematic flow chart of sequence for processing residual fractions at Bayway refinery of Esso Standard Oil Co.

good quality distillates from residual-fuel blending.

Conversion Problems

The conversion of refinery fuel systems to the handling of high-viscosity residual stocks entails a number of problems, many of which may be peculiar to the individual refinery. Many existing fuel systems which have been expanded through the years will prove too complex to adapt to high-viscosity fuel. High temperatures are required throughout the system to move heavy tar and pitch, and adequate precautions must be taken to purge lines with steam or fluxing stocks during emergency or planned shutdowns.

Proper temperature control of the fuel at the burners is important. Fluctuations in fuel temperature cause appreciable variations in viscosity and atomization of the oil, in turn resulting in erratic burner operation. Some modification in design is required for burners handling the high-viscosity fuels, and a few problems still remain in this field.

Despite these problems, many operators consider these high-B.t.u. stocks as excellent fuel and believe that the advantages gained offset the precautions required in handling it. In the opinion of some engineers, any such material, no matter how heavy, can be successfully burned if it can be delivered hot enough to the burners.

Bayway Practices

Esso's Bayway refinery employs a combination of modern processes which produce a maximum yield of distillate fuels. New processing facilities now under construction will further improve the distillate yield, reducing the net production of heavy residual fuels still further. The accompanying schematic flow chart outlines the sequence of processing bottoms streams in the refinery.

The remaining residual fraction from the bottom of the visbreaker flash tower is a heavy thermal tar with a softening point between 150° and 200° F. This is charged to two strippers for removal of final traces of volatile matter.

This heavy thermal tar has a specific gravity of 0.94 at 450° F. Its specific heat is 0.53 B.t.u. per pound per degree Farenheit and it has a latent heat of fusion similar to asphalt. The absolute viscosity averages 20 cp. at 450° F. and the viscosity, 1,200 S.s.F. at 210° F.

A fraction of this heavy residuum is withdrawn from the strippers at about 525° F. and is circulated through a loop system which supplies an average of 2,000 bbl. per day of heavy fuel to the refinery's pipe stills. This circuit comprises about 2,500 ft. of 2 and 3-in. insulated pipe. Temperature of the heavy fuel is sustained at the desired combustion level by continuous recirculation through the stripper which serves as a surge tank. A back pressure is maintained on the return line to the stripper to provide constant pressure to all burner legs in the system. Dead-end burner legs are designed for minimum length. Each leg is equipped with control valves and fuel is metered to each bank of burners at the furnaces.

Although temperature loss is normally minimized by recirculation through the stripper, it has been found desirable to provide external steam tracing on the fuel lines for protection against periods of temporary low flow. In this type of system using 100-psi. steam, protection is provided against temporary disturbance, but the tracing does not supply enough heat input to prevent the fuel from setting up and plugging the line during shutdowns.

Hence, facilities for purging the system with steam or fluxing stock are necessary. In case of pump failure, the system can be switched to an alternate pump taking suction on the stripper serving the pipe stills. The system can also be supplied from either stripper.

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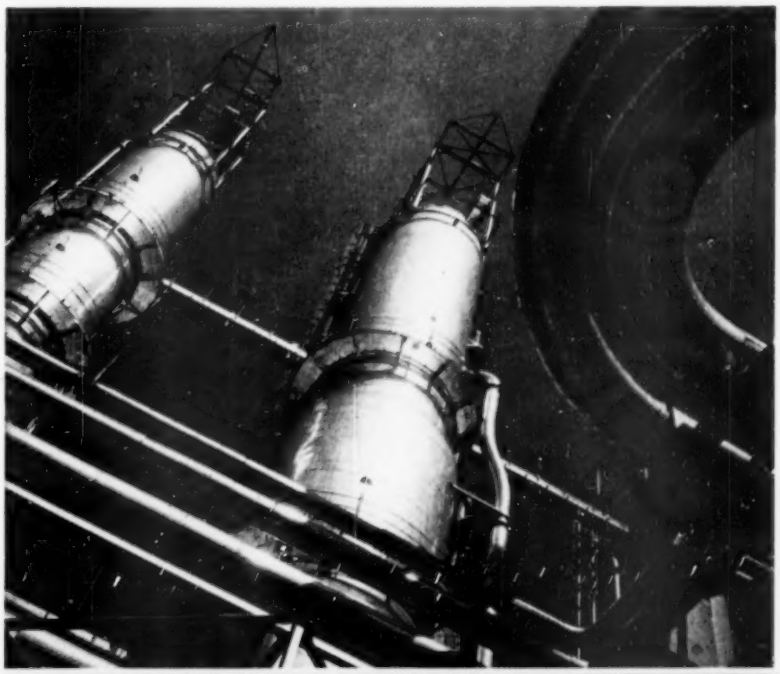

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A second high-viscosity fuel system fueling the central boiler house takes suction from the line moving hot residuum to storage. Normally this system withdraws about 4,000 bbl. per day of straight residuum from the field line before it is fluxed and cooled. The flux lines are so manifolded, however, that boiler fuel can be blended with distillate if desired.

Burner design . . . The burner conditions imposed in handling high-viscosity fuels at elevated temperatures necessitated a number of detailed design modifications. In addition, burners must be designed to resist abrasions from small coke particles sometimes present in thermally cracked residua.

Several years of development in cooperation with National Airoil Burner Co., of Philadelphia, have resulted in a burner design which satisfactorily meets the requirements for this type of service. Work is continuing toward development of still better burners for high-viscosity fuels.

The principal problems encountered in burner service involve ignition, selection of proper materials, abrasion, and maintenance of purging facilities. To insure immediate ignition of the fuel-air mixture, sufficient incandescent refractory must be provided in close proximity to the burner tip. In addition, a small inspirating gas pilot is provided across the burner.

Alloy steel must be substituted for bronze in valves, burner gun, and other parts to assure satisfactory service at high temperatures. Abrasion of burner tips by coke particles long posed a serious problem. This has been solved by use of a very hard metal alloy. Seamless pipe has been adopted as standard in designing the new high-viscosity-fuel burners.

Burners must be designed to permit steam tracing or other heating facilities right up to the burner connection. Heavy insulation is also required. Maintenance is minimized by simplifying the removal and installation of burner guns, and by providing for steam blowing or purging of all burner lines and valves from easily accessible locations. In the case of upfired floor burners purging can be done from platforms alongside the furnace.

When burning a high-viscosity fuel at a temperature of 550° F., for example, the use of steam of less than 100 per cent quality causes the flashing of the small percentage of water by the hotter fuel. This leads to pulsations and erratic burner operation. Dry, superheated steam must therefore be

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provided at the burner. Upfiring floor burners are considered the most difficult type to adapt to high-viscosity fuels. A number of burners of the improved design have proved successful in this service.

Thermal Electric Heating

At Bayway the circulating fuel system serving the pipe stills is now being converted to the use of electrical heat to maintain desired fuel temperature. This new system of temperature control will obviate the need for steam tracing and for fuel recirculation to the strippers.

Equipment purchased from Fluid Systems, Inc., will be installed to provide "thermal electric" heating of the entire system. This consists of impressing a low-voltage alternating current on the pipe walls, using the pipe as an electrical conductor. The generated heat can be thermostatically controlled within plus or minus 5° F. to offset the normal heat losses through the walls of the pipe. This makes possible the maintenance of a desired fuel temperature throughout the dead-end system regardless of its length, or the rate of fuel flow.

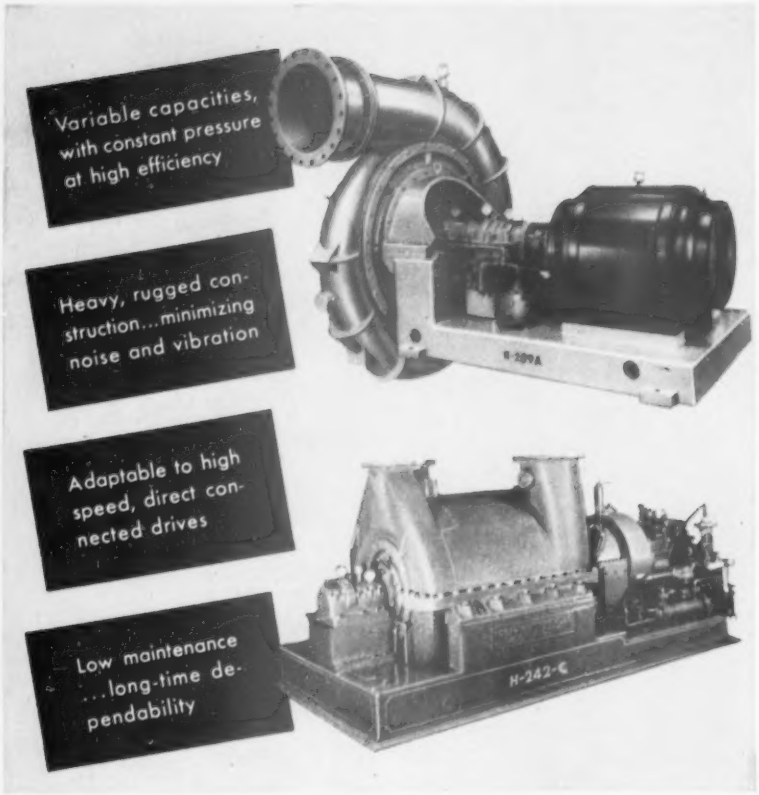
The system at Bayway is designed to maintain a minimum fuel temperature of 450° F. under all conditions of flow or standby. Since the fuel enters the system at 525° F., little electrical heat input will be necessary during normal operation.

In case of shutdown, the system can maintain the heavy fuel in a fluid condition. However, should solidification occur for any reason, the system can restore fluidity, since capacity is provided to raise the temperature of the fuel from 0° to 450° F. in 72 hours.

The primary electrical characteristics are 440 volt, 60 cycle, 1 phase. Secondary voltage not to exceed 24 volts will vary depending on the length of pipe in each circuit. No special safety precautions are needed because of low voltage in the heating circuit itself. The average circuit will be about 120 ft.

The burner headers will be included in the Thermal Electric System. While this requires special insulating flanges for the burner takeoffs, the cost is justified since burner headers are particularly critical because of low fuel velocity and long holdup time.

All lines in the system will be insulated with 3 in. of magnesia or its equivalent. Disconnect switches will be installed at each pipe still to deenergize the electrical circuits during turnarounds. A temperature indicator at each furnace header will connect to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Your specific needs may dictate other important characteristics in centrifugal blowers or exhausters. But even so, these four values are essential to over-all successful performance. You'll find them in every Roots-Connersville Centrifugal Unit, regardless of size. And if you desire variations to suit your application, the ability to meet these needs is a heritage of our 100 years' specializing in equipment to handle gas and air.

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existing instruments in the respective pipe still control houses.

Improved Operation

The new fuel system for the refinery's pipe stills is expected to provide more uniform burner operation by permitting closer fuel temperature control. This is important in handling the high-viscosity fuels because of the wide viscosity variations encountered when temperatures are not adequately controlled. Pressure control and the use of centrifugal pumps to avoid pulsation will further serve to maintain uniform burner operation.

The added advantage gained from electrical heating is the insurance against pressure drop or outright plugging of the system which would result from a lowering of the fuel temperature. Heat input will be required during extremely cold winter weather, to maintain proper temperature at the end of the system. Fuel can be maintained in fluid condition on temporary standby occasioned by pipe-still shutdowns, or substitution of excess refinery gas for heavy fuel.

The elimination of steam tracing and recirculation to maintain heat will substantially ease maintenance costs of the fuel system. Operating costs will also be cut by eliminating the need for purging or blowing of lines during scheduled or emergency shutdowns.

Electric heating facilities cannot economically be applied in place to many existing fuel systems. Also, because of the usual complexity of such systems, the use of this type of temperature control on any individual component would gain little advantage. Energy costs are frequently higher than for steam. In systems with high input temperatures, however, energy consumption is considered to be a minor cost item.

Deposits resulting from the use of heavy residuals have posed no serious problems at Bayway. Furnace tubes are successfully cleaned of deposit scale by water washing during scheduled unit turnarounds. Although tube-metal temperatures exceed 1,000° F. in some cases, engineers report no serious corrosion attributed to vanadium in the heavy fuel.

With proper handling and burning facilities, high-viscosity fuels such as thermal tar and asphalt pitch comprise excellent, high-B.t.u. fuels. No viscosity limitation on their use is anticipated, provided they can be admitted to burners at a sufficiently high temperature to assure atomization. These new developments in the utilization of low-valued residual as refinery fuel will contribute to the over-all economy of the refining operation.

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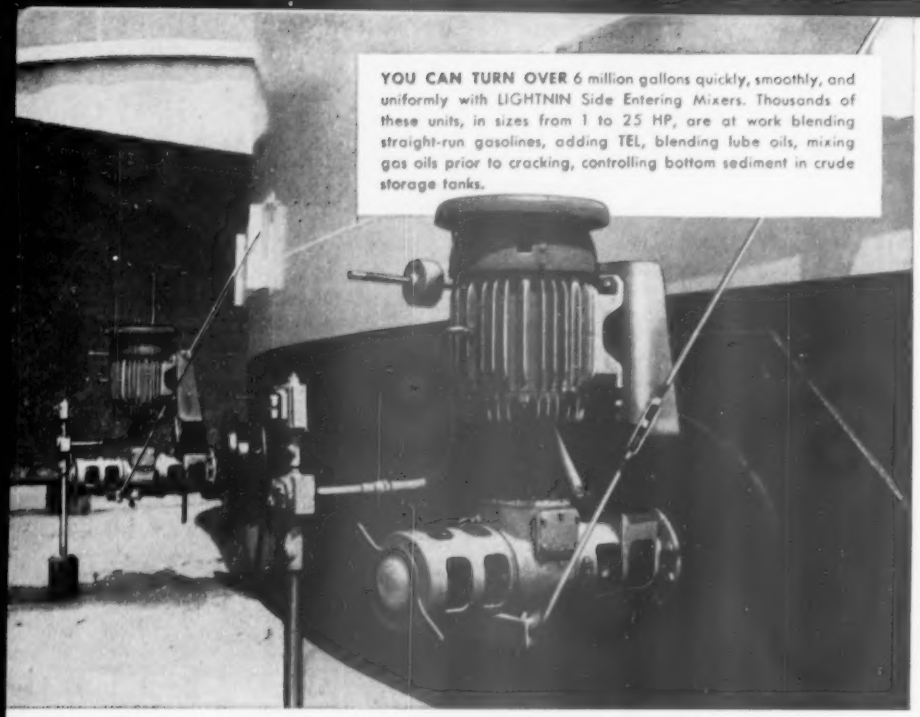

YOU CAN TURN OVER 6 million gallons quickly, smoothly, and uniformly with LIGHTNIN Side Entering Mixers. Thousands of these units, in sizes from 1 to 25 HP, are at work blending straight-run gasolines, adding TEL, blending lube oils, mixing gas oils prior to cracking, controlling bottom sediment in crude storage tanks.

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Save on upkeep, too

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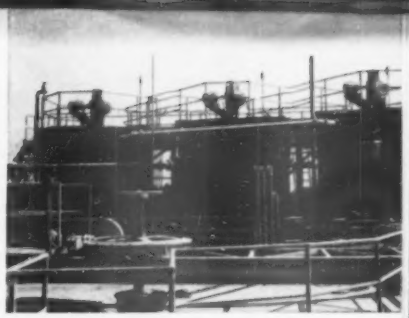
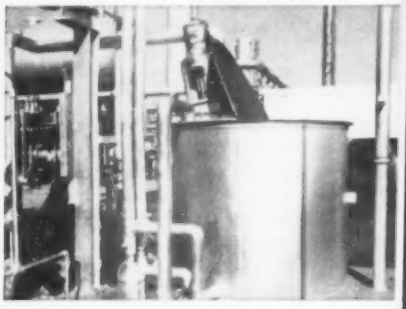
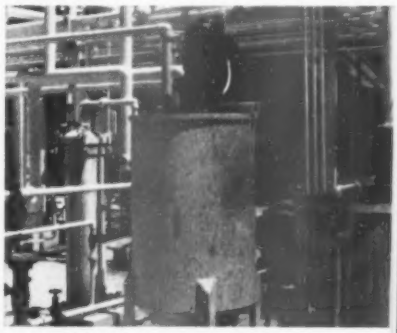


CAUSTIC TREATING and other mixing jobs become fast, efficient operation with turbine-type LIGHTNIN Mixers. You can mix, blend, suspend solids, get intimate gas-liquid and liquid-liquid contact, in open tanks or closed pressure vessels with these units. Standard sizes from 1 to 500 HP provide hundreds of power-speed combinations.



FOR TANKS up to 3,000 gals., continuous or batch mixing, pipeline mixing, there are 30 LIGHTNIN propeller-type models to choose from. Sizes ¼ to 3 HP.



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INSTRUMENTATION ASSEMBLY for measurement of liquid levels in HF-alkylation applications. At left is recording instrument; at right is probe assembly.

HF ALKYLATION

. . . the process and its control

by J. E. Hewson

MEASUREMENT of liquid level, long a problem in certain HF-alkylation applications, is now accomplished in trouble-free manner, with good precision and accuracy throughout range of the measuring element.

The instrument which accomplishes this utilizes the balanced-bridge principle, with two sides of the bridge composed of equal impedence, and two composed of variable capacitors, as shown in Fig. 1.

Author is associated with the Foxboro Co., Tulsa.

One variable capacitor is a probe, which consists of Teflon extruded over an aluminum rod. The extrusion process results in a capacitor completely covered by a solid sheath of Teflon. This capacitor assembly is installed in a steel pipe attached to the vessel in which level is to be measured, as shown in Fig. 2.

As the interface level moves up and down, the probe is exposed to more or less of the HF layer, which is conductive, and to less or more of the hydrocarbon layer, which is nonconductive. This results in a change in effective capacitance in the bridge circuit, and null balance of the bridge is destroyed.

Resultant flow of current is sensed by a capacitance-type electronic instrument which actuates the solenoid mechanism driving the other variable capacitor. The capacitance of this element is adjusted to again bring the bridge into balance. The recording pen is positioned by the solenoid mechanism driving the variable capacitor.

A typical chart on interface level is shown in Fig. 3. The element is used to detect the interface in the acid settler, acid-stripper feed drum, acid-stripper overhead accumulator, and level in the fresh acid storage drums.

Typical HF-Alkylation Process

The feed stock for the alkylation process consists of a refinery stream of cracked olefin light ends and isobutane. The refinery stream is a mixture of butanes and butylenes, and may include propane and propylene, and pentane and pentenes which are fractionated from the products of both thermal and catalytic cracking units.

The isobutane is fractionated from

What Is Alkylation?

Alkylation is the union of an olefin (an unsaturated hydrocarbon) with an aromatic, cyclic, or paraffinic hydrocarbon to produce a hydrocarbon the molecular weight of which is equal to the combined molecular weights of the two reactants.

The principal processes for alkylation are:

1. Thermal alkylation
2. Thermal catalytic alkylation
3. Sulfuric acid alkylation
4. HF acid alkylation

Thermal alkylation combines ethylene and sometimes propylene with isobutane under conditions of high temperature and pressure. Temperatures of 950°-975° F. and pressures of 3,000-8,000 psi. are necessary to give yields of alkylate of 70 weight per cent of the hydrocarbons consumed. Ethylene as a feed stock is expensive to produce; propane and ethane are cracked to ethylene in a low-pressure furnace (300 psi.) at 1,450° F.

In thermal-catalytic alkylation, the pressures and temperatures are reduced to approximately 450° F. and 1,000 psi. by using such catalysts as boron fluoride, aluminum chloride, or double halides of alkali metals and aluminum.

Sulfuric-acid alkylation combines olefins such as propylene, butylenes, or pentenes with isobutane using concentrated sulfuric acid as catalyst at temperatures of 30°-70° F. and pressures of 100-150 psi.

The HF acid alkylation process is one in which olefins—such as propylene, butylenes or pentenes—are combined with isobutane in the presence of the anhydrous (98 per cent plus) HF acid catalyst.

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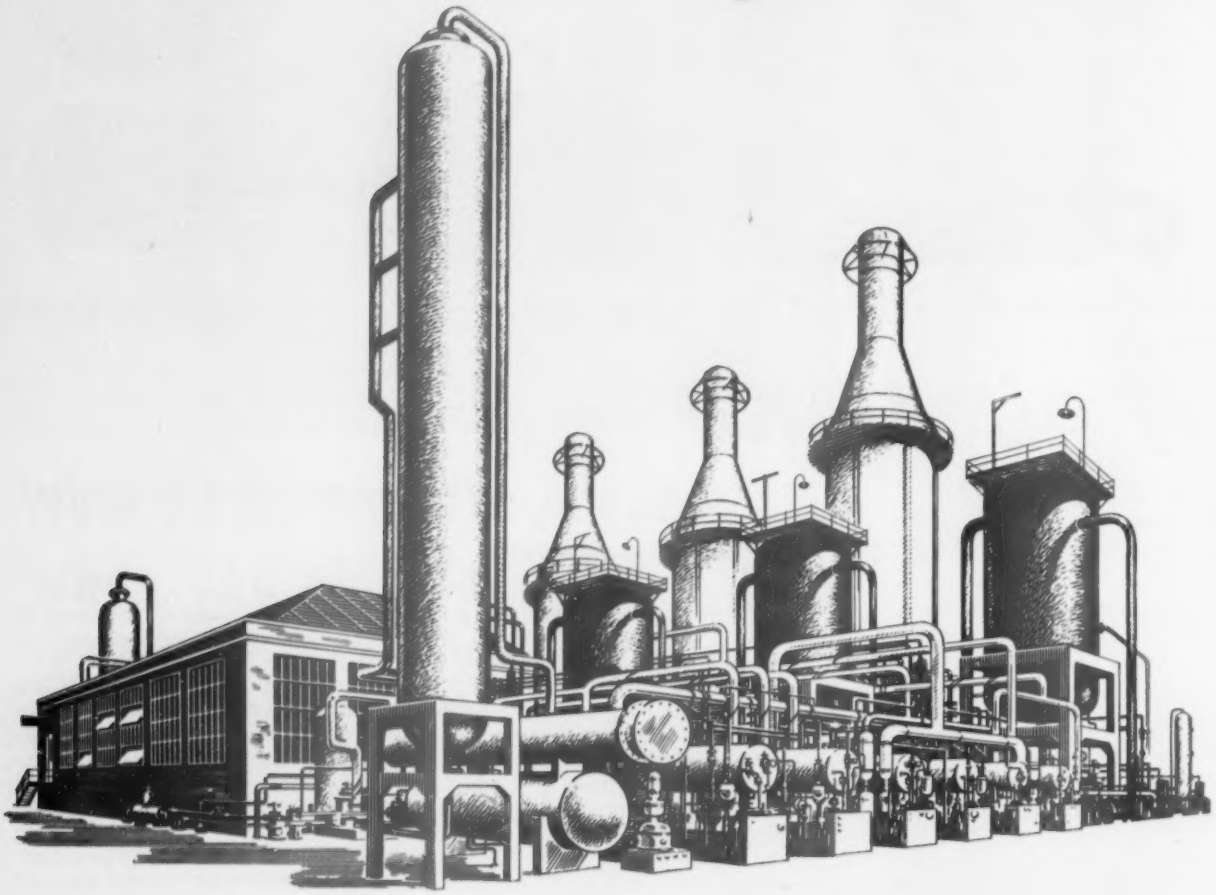

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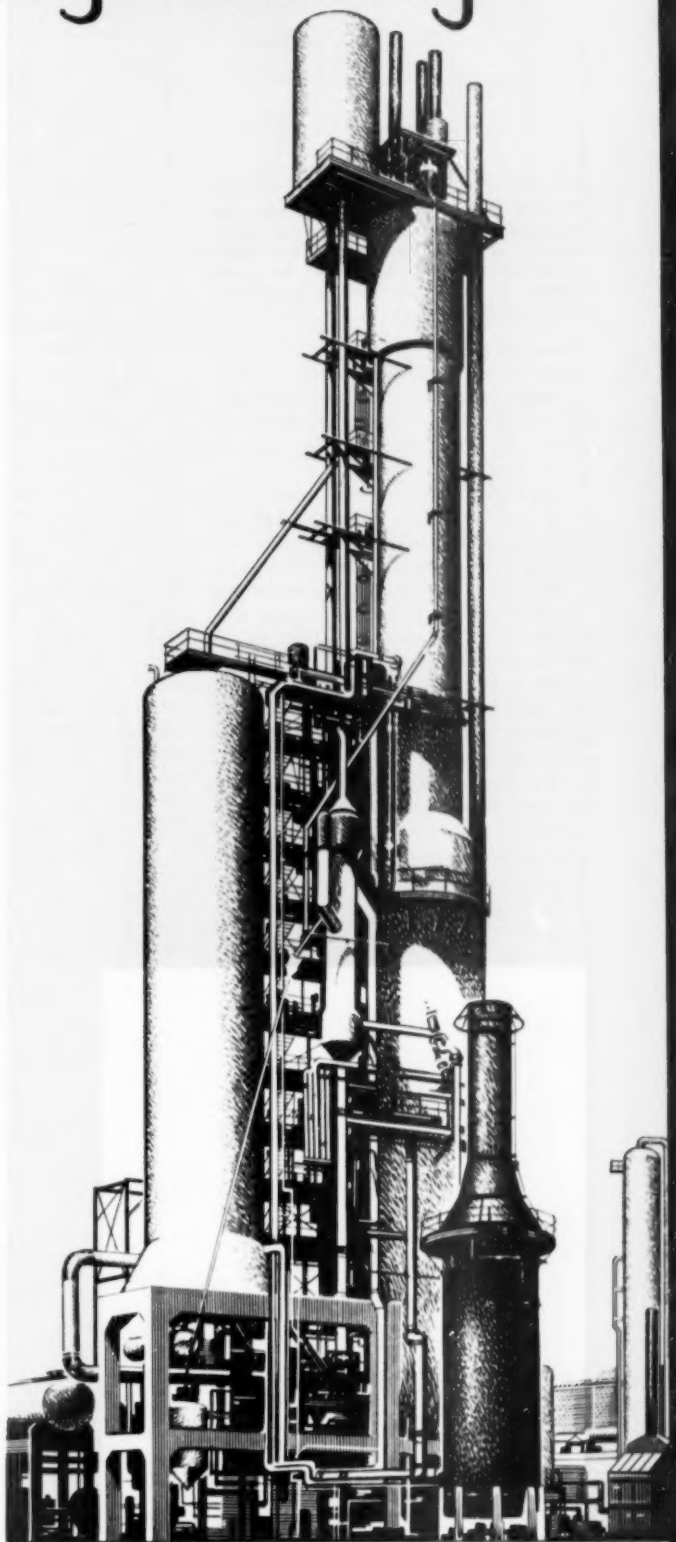
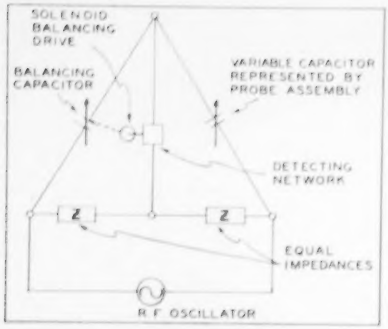
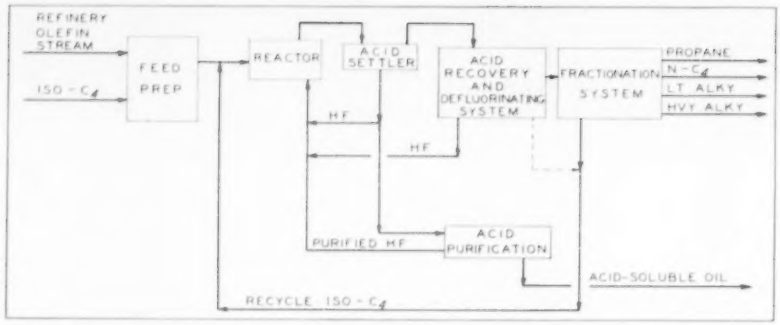
PIONEER IN CATALYTIC PROCESSES





SIMPLIFIED CIRCUIT DIAGRAM for measuring and indicating liquid level under corrosive or high-pressure conditions. Variation in liquid level is detected by the probe assembly, as a result of change in capacitance of this element. Fig. 1.



SCHEMATIC FLOW DIAGRAM for typical HF-alkylation process. Fig. 4.

natural gas or crude or it may be produced in an isomerization unit. Isomerization units convert to isobutane the normal butane which has been obtained by fractionation from natural gas or crude.

These hydrocarbon feed stocks, referring to Fig. 4, are taken through the feed-preparation step where they are dried and, if necessary, desulfurized.

The olefin stream and the isobutane are next mixed with the recycle isobutane from the unit and charged to the reactor where it is either violently mixed with HF acid for periods ranging from 3 to 40 minutes, or allowed to percolate up through the acid. The reaction takes place in the liquid phase during this period. All HF processes use the Stratco contactor, with sufficient water circulation through the tube bundle to remove the heat of reaction. Motor-fuel-quality alkylate can be produced, however, by mixing the hydrocarbon and acid in a series of mixing orifices.

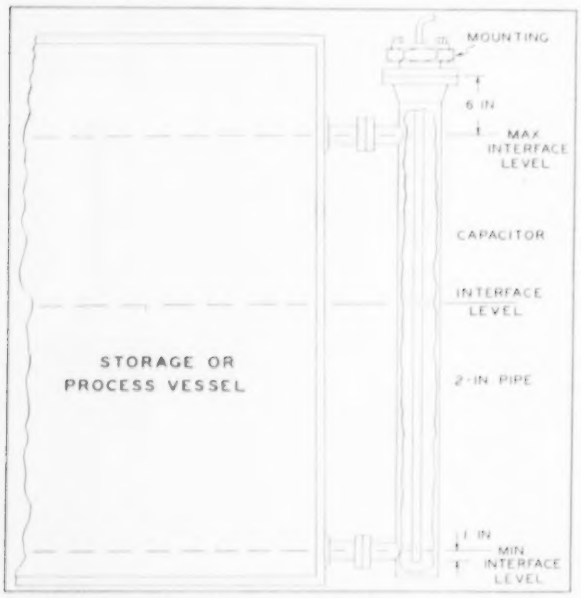
The mixture of hydrocarbon and acid effluent from the contactor goes to an acid settler where the acid separates to a bottom phase in less than 1 minute and is recycled to the contactors. The hyrocarbon top phase is drawn off the top of the vessel and pumped to the acid stripping or azeo tower, first going through a feed surge drum and a feed preheater.

When the hydrocarbon from the acid settler is fed to the acid stripping section, it contains 1-2 per cent HF acid which must be recovered for reuse as catalyst. It also contains a small percentage (in the range of 0.03 per cent) of alkyl fluorides which must be removed to improve the quality of the alkylate, and if possible recover the HF involved for reuse.

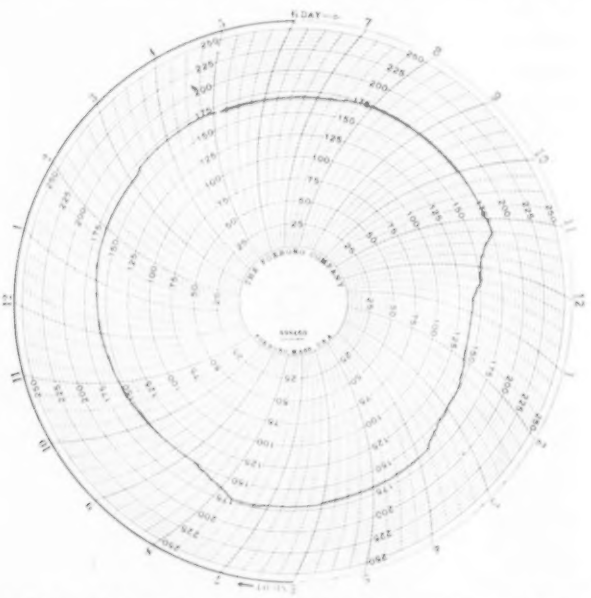
The feed to the stripper tower, or azeo tower, enters at the mid-point of tower or bottom of rectifying section; the acid with some light hydrocarbons is flashed off. This overhead product is collected in an accumulator, the HF settled out and returned to the acid settler, while the hydrocarbon phase in the accumulator is refluxed back to the tower with a small side stream continuously removing propane. A small quantity of acid is removed as depropanizer overhead product along with some propane. The remainder of propane is withdrawn at the bottom on L. L. control and passes to L.P.G. through caustic neutralizers.

The azeo tower bottoms proceed as feed to the deisobutanizer. The deisobutanizer overhead is accumulated in the isobutane surge drum and recycled to the contactors along with fresh isobutane.

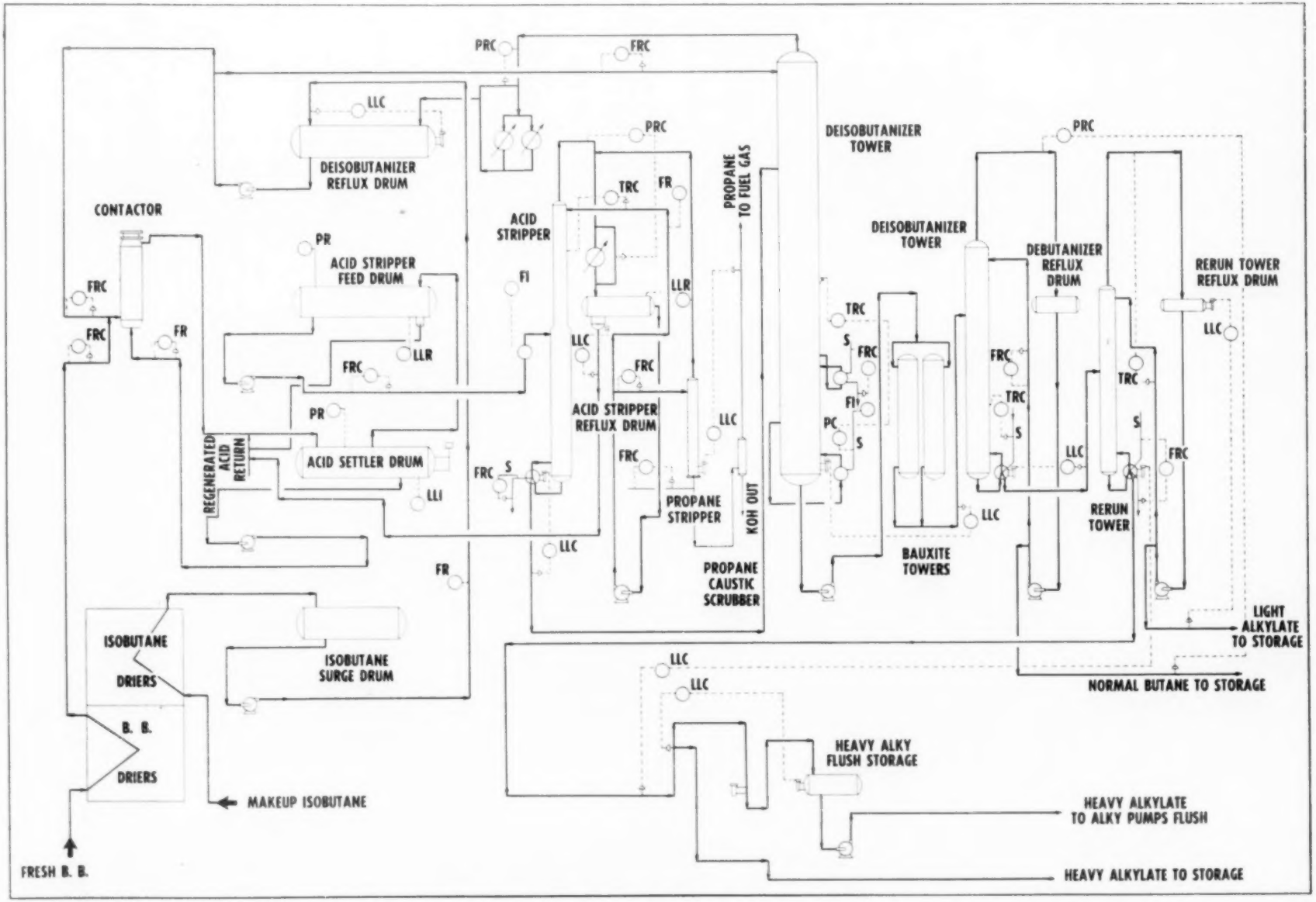
Deisobutanizer bottoms pass through bauxite towers, to catch any trace of HF, before proceeding to the debu-



TYPICAL INSTALLATION of probe assembly on a process vessel. In HF-alkylation work this element is used to detect the HF-hydrocarbon interface in several vessels. Fig. 2.



TYPICAL LIQUID-LEVEL CHART obtained in recording acid-hydrocarbon interface levels in HF alkylation. Fig. 3.



TYPICAL INSTRUMENTATION of an HF-alkylation process is outlined on this flow sheet of the unit at the Ponca City refinery of Continental Oil Co. (Fig. 5).

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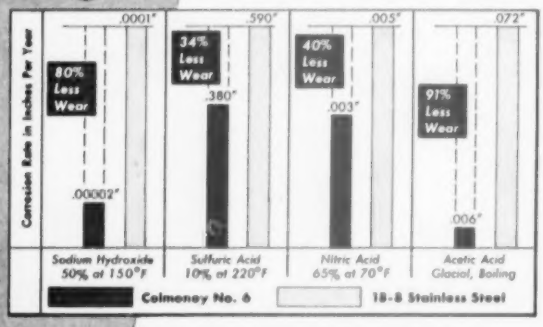
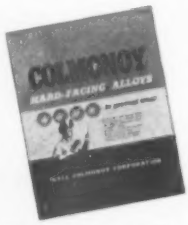
Table shows metal loss in inches per year of 18-8 stainless and Colmonoy No. 6, caused by the corrosive media indicated.





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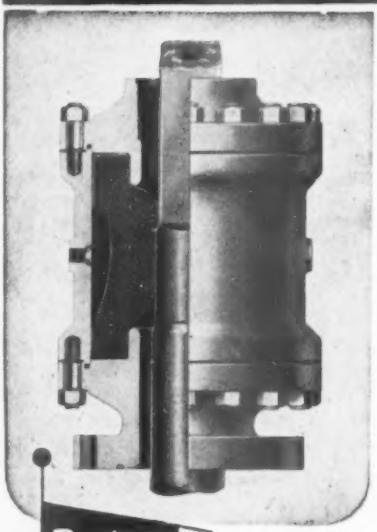

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tanizer. Normal butane overhead is returned to storage for use as L.P.G. or feed to dehydrogenation units in the feed-preparation section.

The final tower in the fractionation section splits debutanizer bottoms into light and heavy alkylate. Light alkylate goes for aviation fuel and is the primary product of the HF process. Heavy alkylate is used as motor fuel blending stock.

The final phase of the process is the regeneration of the catalyst, accomplished in the acid rerun unit. It consists of a small fractionating column charging a small bleed stream off the acid charge to the contactors (85-90 per cent HF); yielding clean acid overhead (90-95 per cent HF acid); and rejecting a small amount of water, and the acid-soluble oil formed in the reaction, out of the tower bottom. The amount of acid lost from the acid rerun unit is very important to the economics of alkylation, as it can be one of the major losses of HF acid, if not properly controlled. HF acid in tank-car lots costs 21 cents per pound.

Charge stock preparation . . . The charge stock for an HF alkylation unit must meet two requirements: (1) it must be essentially free from sulfur, and (2) it must be as dry as possible. Both sulfur and water in the charge stock cause a dilution of the HF acid and reduce its effectiveness.

The presence of sulfur compounds in the olefin stream charge stock, usually called butane-butylene feed or simply B-B feed, results in increased production of acid-soluble oil. The sulfur compounds polymerize rapidly with olefins to form a fairly light acid-soluble oil, which if not removed by the acid rerun unit, build up until they appear in the heavy alkylate throwing it off color and causing it to be sour and corrosive. Ordinarily, sulfuric compounds in the B-B feed are tolerable to 0.01-0.2 per cent by weight; as the sulfur content approaches 0.10 per cent, the acid rerun requirements increase so rapidly that the usual-size equipment is not able to handle it. If the sulfur content of the B-B feed or fresh isobutane feed is high, caustic washing by the usual methods is warranted.

Dehydration, although it involves very little in the operation of an alkylation unit, is one of the important steps. All water entering the acid section of the alkylation unit is absorbed by the acid and reduces its strength. This water must be removed through the acid rerun unit or it would build up until the acid was not strong enough for good alkylation but was just right for extremely rapid corrosion.

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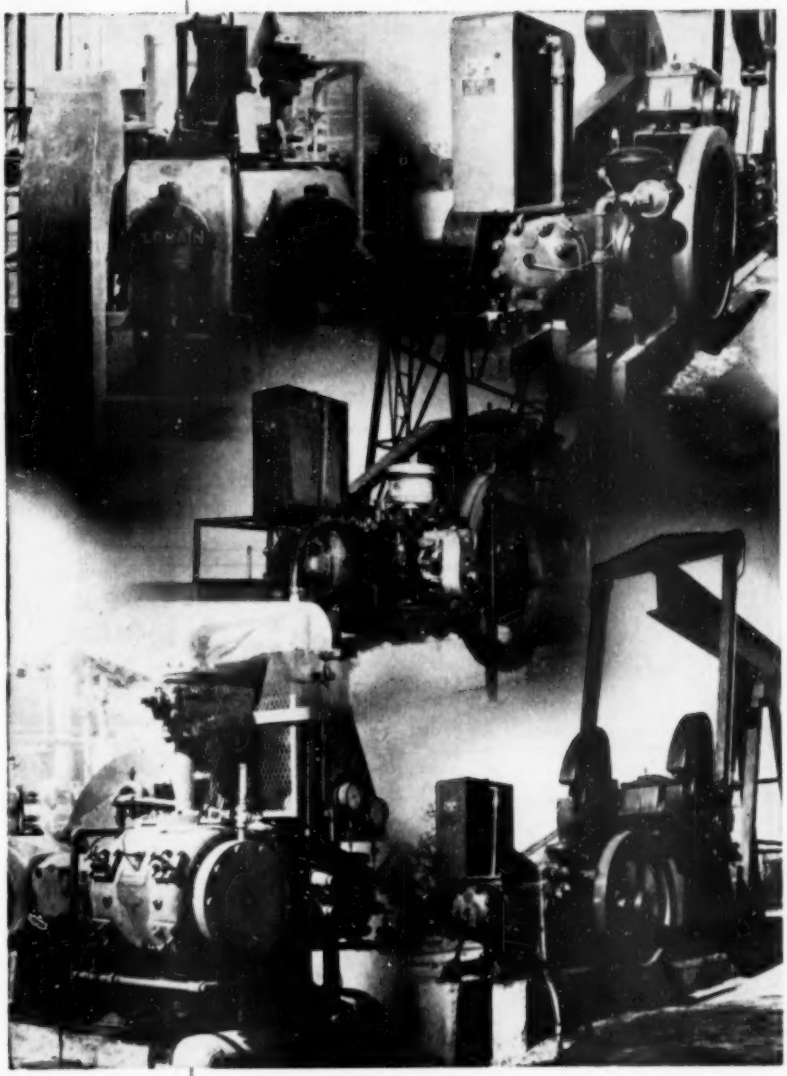

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When water and HF acid mix, a constant boiling mixture is obtained that is called an azeotrope; this mixture is 63 per cent water and 37 per cent HF and cannot be further separated by simple fractionating methods. Therefore, for every 63 lb. of water entering the system and being rejected by the rerun unit, **at least** 37 lb. of HF acid must be rejected with it as the azeotropic mixture. The acid rerun unit would be working absolutely perfectly if it rejected only the azeotrope; usually it is considered good if the acid-water ratio is 1 to 1.

Contacting and settling . . . After being dried, the B-B feed, isobutane fresh feed, and the recycle isobutane are pumped to the contactors. Usually contact times or residence times in contactor vary over quite a range from 4 to 40 minutes, while a good average and sufficiently long time for completion of the reaction is 10-15 minutes. Since the alkylation reaction between an olefin and isobutane releases 300 B.t.u. per pound of alkylate formed, considerable quantities of cooling water must be circulated through the tube bundle immersed in the contactor liquid in order to maintain the reaction temperatures within the range of 80°-115° F.

The effluent from the contactors goes to the acid settler where the acid settles rapidly to the bottom and is recycled back to the contactors. The acid settler is carried liquid full and the hydrocarbon top phase is drawn off the top of the vessel to the acid stripper feed surge drum. Any small amounts of acid that further settle out in this feed surge drum are periodically pumped back to the acid settler. Only small amounts of acid are carried in the settler, in fact only enough to maintain a definite level for suction to the acid feed pumps. For instance, all the acid in the system usually totals about 200 bbl., while more than 1,000 bbl. of acid per hour are circulated through the contactors.

Defluorination operations . . . Defluorination of the hydrocarbon phase of the effluent from the contactors is accomplished by a combination of azeotropic distillation and bauxite treatment. After azeotropic distillation in the azeo tower (acid stripper) and propane stripper, remainder of fluorides left in the alkylate stream must be removed by bauxite defluorination. The amount of fluorides present in the stream is very small, usually 0.01-0.02 per cent by weight; yet this small amount will lower alkylate quality and make it corrosive or nearly so on the copper-strip corrosion test in the laboratory.

Therefore, the stream is passed

through bauxite towers, containing 4-8 mesh bauxite, at 180°-190° F. and sufficient pressure to insure that the hydrocarbon is liquefied. The bauxite combines with the fluorine from the fluorides to give aluminum fluoride, water, and the olefin of the fluoride reacted. Usually two bauxite towers are used in series; the primary tower removes about 90 per cent of the fluorine, and the secondary removes about 80-90 per cent of what is left. Thus 95-99 per cent of the fluorine is removed.

There are small traces of free acid left in the stream and this reacts with the silica impurity in the bauxite to give fluosilicic acid which is carried out with the hydrocarbon and will deposit out in the debutanizer condensers or wherever it contacts with liquid water. This silica migration is counteracted by mixing a small amount of quicklime with the bauxite which reacts with the acid before the silica does, and by holding the velocity through the bauxite low.

Fractionation . . . The fractionation system of the alkylation unit is pretty much standard for equipment fractionating light hydrocarbons. Fractionation is fairly close since only propane, butanes, and alkylate, which is of gasoline range, are produced.

Catalyst regeneration . . . The HF acid becomes diluted with water and acid-solube oil and must be cleaned by removing these diluents as they are produced. Water content of the acid is usually kept below 2 per cent by weight; above 2 per cent, it is believed the corrosive action of the acid on the equipment becomes appreciable and uneconomical. No set figure is known for the tolerance of acid-soluble oil content of the acid, but it is known that as the oil content increases and the acidity decreases, then the oil production increases. In other words, it has a pyramiding effect. Usually, the acid-soluble oil content is maintained below 5 per cent.

Several methods of operating an acid rerun unit are used. A small bleed stream off the acid to the contactors is pumped to the rerun unit; the size of the stream is governed by the amounts of acid-soluble oil and water that must be removed. The acid may be cleaned up by simple fractionation, flashing most of the HF overhead and reboiling the oil and water in the bottom of the tower. This removes all the HF possible from the bottoms make, consisting of oil and the acid-water azeotrope.

The acid-soluble oil make off the rerun unit presents a problem in disposal.

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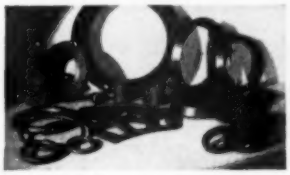

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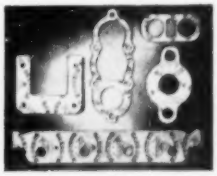

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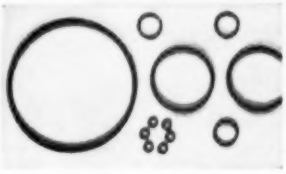

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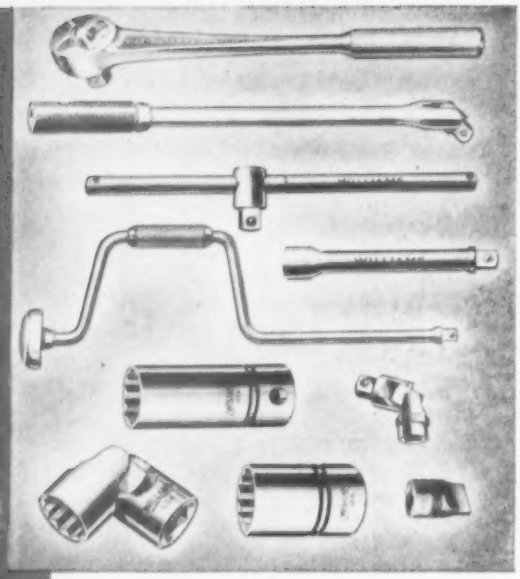

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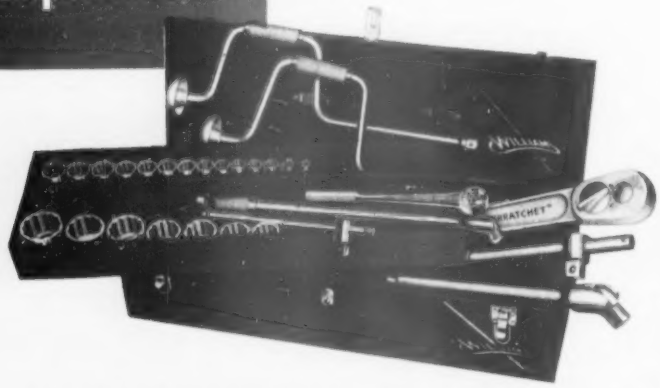

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The acid is washed away from the oil with water, and the oil is sent to fuel oil. The water wash through from the acid-soluble oil is high in fluoride content and may not be dumped as ordinary waste. The fluorides are neutralized by lime or alkali of some sort the calcium fluorides settled out, and the water may then be dumped as ordinary waste water.

Physical properties of HF . . . Hydrofluoric acid is a strong acid and has several peculiar physical properties. It is a colorless liquid when new, in both anhydrous and aqueous forms, but in the alkylation unit it immediately dissolves small amounts of hydrocarbon and is usually colored ranging from a pale yellow straw color to brown, depending on its purity. It has a sharp characteristic odor.

Hydrofluoric acid boils at 67° F., which means that at ordinary outdoor temperatures it will boil away or vaporize with white smoke-like fumes, and any pure acid spills will eventually boil away. It has a gravity nearly equal to water and, for rough calculations, can be assumed to be the same, 350 lb. per barrel.

The viscosity of HF is considerably less than that of water, at 32° F. Water has a viscosity of 1.8 centistokes and HF acid 0.3 centistokes. The molecular weight of HF vapor, depending on temperature and pressure conditions, may vary from 20-120, which complicates calculations of fractionation. The formula for liquid HF acid is often written H_6F_6, molecular weight 120.

Solubilities of hydrocarbon and HF acid are somewhat important. Isobutane and butane are soluble in HF acid to the extent of about 5 per cent by weight at 100° F. This means that the acid pumped from the acid settler to the contactors will contain about 5 per cent isobutane in addition to the water and acid-soluble oil dissolved in it. Acid-soluble oil and water are completely soluble in the HF acid. Also, HF acid is soluble in propane, isobutane, normal butane, and other hydrocarbons. Hydrocarbon at 100° F. pumped from the acid settler to the catalytic defluorinator will contain about 1 per cent HF acid, which is stripped out overhead.

Water is soluble in HF acid in all proportions and forms a constant boiling mixture of azeotrope of 37 per cent HF and 63 per cent water. This azeotrope boils at 232° F. at atmospheric pressure.

Vessels and piping . . . All vessels in the alkylation unit are of carbon steel of standard design. A small allowance in wall thickness is made for corrosion on vessels where it is necessary, such

as acid rerun unit and certain acid exchangers. Corrosion is much less severe in an HF alkylation unit than it is in a crude unit processing sour or high-sulfur crude. Flanges on vessels in acid service or acid and hydrocarbon are of the ring-joint type, while flanges on vessels in service for hydrocarbon with small amounts of acid are of the standard raised-face type with metal gasket.

Vessels for straight hydrocarbon service use the gasket and flange applicable for that type hydrocarbon under the particular operating conditions. Vessels for these pressures and temperatures are usually stress relieved and raidographed; this is good practice for vessels that are designed for acid service.

In designing piping for an alkylation unit, an extra-heavy pipe is usually called for in acid service to give some allowance for corrosion, although ordinary weight piping (Schedule 40) will give good service with a somewhat shorter life in most instances. All piping is of carbon steel. Flanges in acid service are ring joint, with raised face flanges for other service. As few flanges and connections as possible are used to reduce number of opportunities for leaks to occur.

Pumps . . . All pumps in acid service are equipped with a special stuffing-box insert installed over a flame-hardened shaft, which allows injection of a flushing stream of isobutane or n-butane (depending on pump service) and a sealing stream of lubricating oil on the inboard end of the stuffing box. The insert is threaded so that isobutane or n-butane seal is forced inward to the pump casing; clearances of 0.020 in. are allowed to prevent heating and vaporizing of the seal.

Line valves . . . Considerable difficulty with stuck and broken valves was experienced in early operations. This has almost entirely been eliminated by several changes. The inner working parts of all valves in acid service have been lined with monel. Now even the small 1-in. gate valves are purchased with monel lining. All large globe and angle-globe valves have been replaced with monel-lined gate valves. All valves in key positions are monel-trimmed gate valves; other valves in acid service are monel lined on plug and gasket seat.

There is a semiweekly greasing schedule for valves. Where positive shutoff is required, double block valves with a bleeder valve between them were installed. Acid gate valves are packed with a solid aluminum foil.

Air-operated control valves . . . Control

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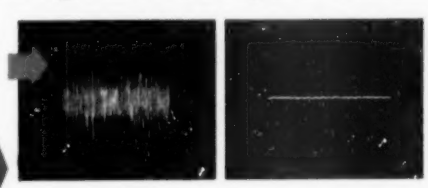

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valves in nonacid service are of the standard type generally employed in the refining industry. Control valves in straight acid or acid-bearing hydrocarbon service are cast steel with either RTJ or raised face flanges depending on the concentration of acid and individual company policy. Monel trim and aluminum packing seem to be most widely used. Teflon is being used successfully by one company.

Extended stuffing boxes are standard but extension spools formerly thought desirable are no longer required as most companies have found it unnecessary to use purge on acid service valves. Valve positioners are recommended on critical control applications utilizing the aluminum packing and extended stuffing box.

It should be noted that monel trim on all valves is used because not only does it resist HF acid but the products of HF corrosion from the system will not stick to monel.

Controls . . . Controls in acid service are designed to use as few stuffing-box connections as possible. Instruments are connected as closely as possible to the pressure taps so there are no long instrument lines carrying acid. Measurement impulses are transmitted either electrically or pneumatically to an instrument located in the control room.

Liquid levels are indicated, recorded, or controlled by torsion-tube-type instruments or volumetric displacement floats where applicable. In straight acid or acid-bearing hydrocarbon service the balanced-bridge instrument with a Teflon-coated probe is desirable. Inexpensive high and low-level alarms are available on the capacitance principle and may be incorporated in recording or controlling capacitance units where used.

Pressure instruments are of the standard volumetric displacement type with a pneumatic transmitter. Mechanical seals with monel diaphragms may be used where pressures allow.

Acid flow is almost universally determined by an all-metal differential pressure cell transmitter. These are available in forged steel, 316 S.S. or monel. One company uses standard forged steel with Z-nickel diaphragms and Teflon gaskets. These units are sealed with 14 in. of mercury and it is reported that acid corrosion of the seal line progress is no more than about 3 in. below the mercury level. Because of the corrosive atmospheric conditions in most HF alkylation units, it is recommended that 316 stainless steel cells be used where mercury seals are employed.

Typical HF-unit instrumentation is shown in Fig. 5.

AERIAL VIEW of Suntide's new Corpus Christi refinery shows compact layout and orderly arrangement.

SUNTIDE'S NEW PLANT FEATURES

Vacuum Unit, Fluid Cat Cracker, HF Alkylation, And Propylene Tetramer Unit

. . . and unusual handling of segregated crudes

by F. Lawrence Resen
Gulf Coast District Editor

SUNTIDE REFINING CO.'S completely new refinery at Corpus Christi, Tex., has been placed on stream operating on a crude-oil throughput of 30,000 bbl. per day.

The plant, located on Nueces Bay, is designed to produce a wide range of products and includes a crude and vacuum unit of Lummus Co. design, and a fluid catalytic cracking unit, an HF alkylation plant, and a propylene tetramer unit, all Universal Oil Products Co. design.

Products will include gasoline, jet base fuel, distillate fuel, diesel fuel, tetramer, and residual oils. While the plant has ample truck-loading and tank-car-loading racks, primary movement of production will be via tanker, and the plant is connected via pipe line to a deep-water terminal.

TABLE 1—DESIGN PRODUCT DISTRIBUTION
(Barrels per day)

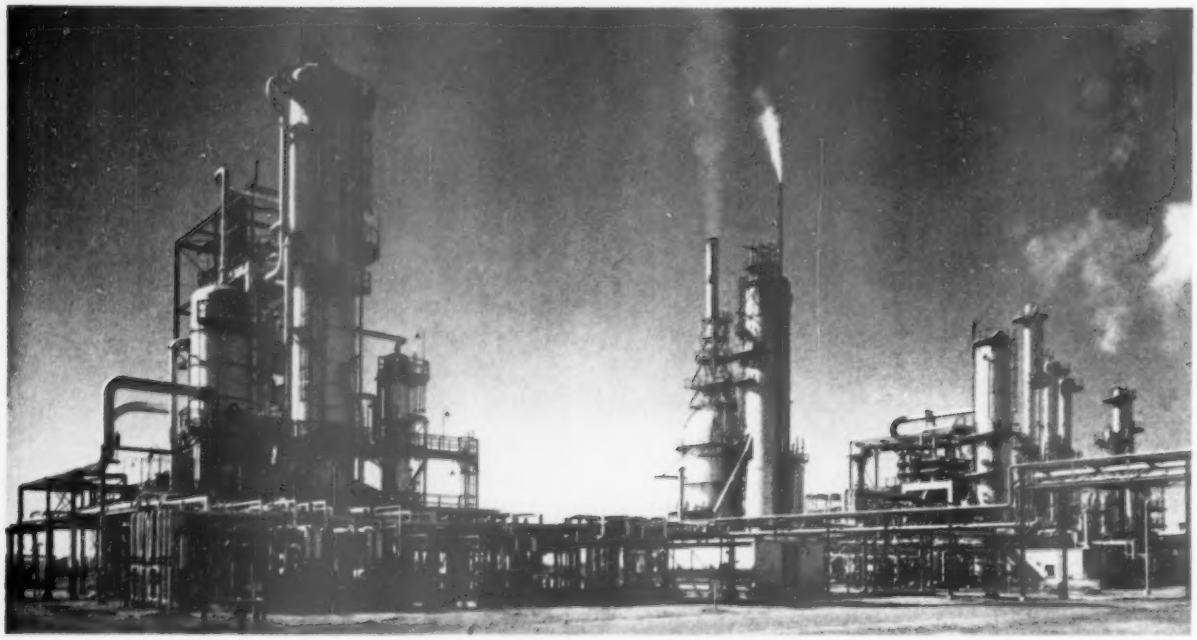
	A	B	C
Crude charge	26,300	26,300	26,300
Gasoline	2,104	9,730	9,730
Jet base fuel	7,890		
No. 1 distillate fuel		8,680	
Diesel fuel			9,995
Cracking stock	14,730	7,360	6,045
Residue	1,576	530	530

Crude unit . . . A most interesting aspect of plant operations is its handling of segregated crudes. It may be noticed in Table 1 that the design product distribution of the heavy crude "A," produces a preponderance of gas oil for catalytic cracking stock and a small amount of gasoline, while the other two crudes have high gasoline yields and low gas-oil output. This latter condition requires the various crude runs be scheduled so as to provide makeup gas oil when the light crudes are run. It also makes necessary some purchase of additional gas oil.

Figures in Table 1 refer to the nominal design capacity of 26,300 bbl. per day. However, the crude unit was modified during shakedown period to handle its present charge, and indications are that further slight changes will up its capacity at least another 10,000 bbl.

Topping-vacuum unit . . . This unit was designed for the separation of crude into straightrun gasoline; a distillate fraction which was to be either jet fuel base, No. 1 fuel, or diesel fuel; catalytic cracking stock; and residue.

This separation is accomplished in two main fractionating towers, the first



PROCESSING UNITS at Suntide refinery include crude distillation units, at left; cat cracker, center; and gas-concentration plant, at right.

operating at a few psi. pressure, and the second under vacuum. The crude charge pump takes suction directly from the refinery crude-storage tanks. The crude is pumped through a train of exchangers utilizing product and reflux streams as the hot medium. After the exchanger train the crude is further heated in a gas-fired heater utilizing both convection and radiant heat surfaces.

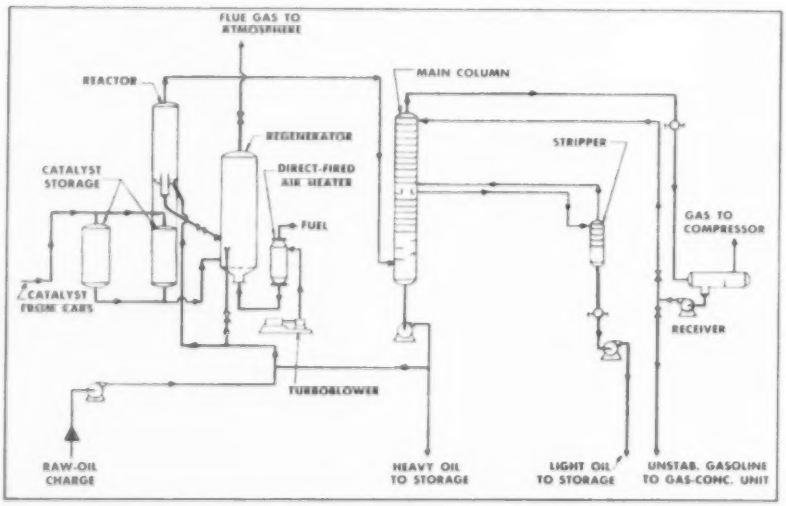
The first tower is provided with overhead and side reflux systems as well as two sidestream strippers. The overhead from the main tower consists of a two-stage condensing system. The function of the first stage is to condense reflux at a higher temperature level and the second stage is to condense the product gasoline. The top stripper is utilized to withdraw the distillate cut, while the lower stripper is utilized to withdraw an atmospheric gas oil. The side reflux is withdrawn from the same tray as the distillate, thus making it possible to utilize reflux heat for crude preheat at a higher temperature level than could be obtained if only top reflux was used.

Vacuum tower . . . The stripped bottoms from the first tower are pumped through a separate heater into the vacuum tower. The vacuum system is so designed that the main portion of the flashed gas oil is condensed in the tower by means of a circulating gas-oil reflux. The overhead from the vacuum tower is principally steam which contains equilibrium gas oil. A primary condenser is utilized to condense the major portion of the gas oil going overhead, while a second condenser condenses the steam and the remaining gas oil. A steam jet evacuates the noncondensables from the secondary condenser and discharges into a barometric condenser. The stripped bottoms from the vacuum tower are pumped through a pipe coil cooler box to storage. Due to the very small percentage of bottoms from the vacuum tower, provisions have been made for recirculating both bottoms and overflashed materials through the vacuum heater.

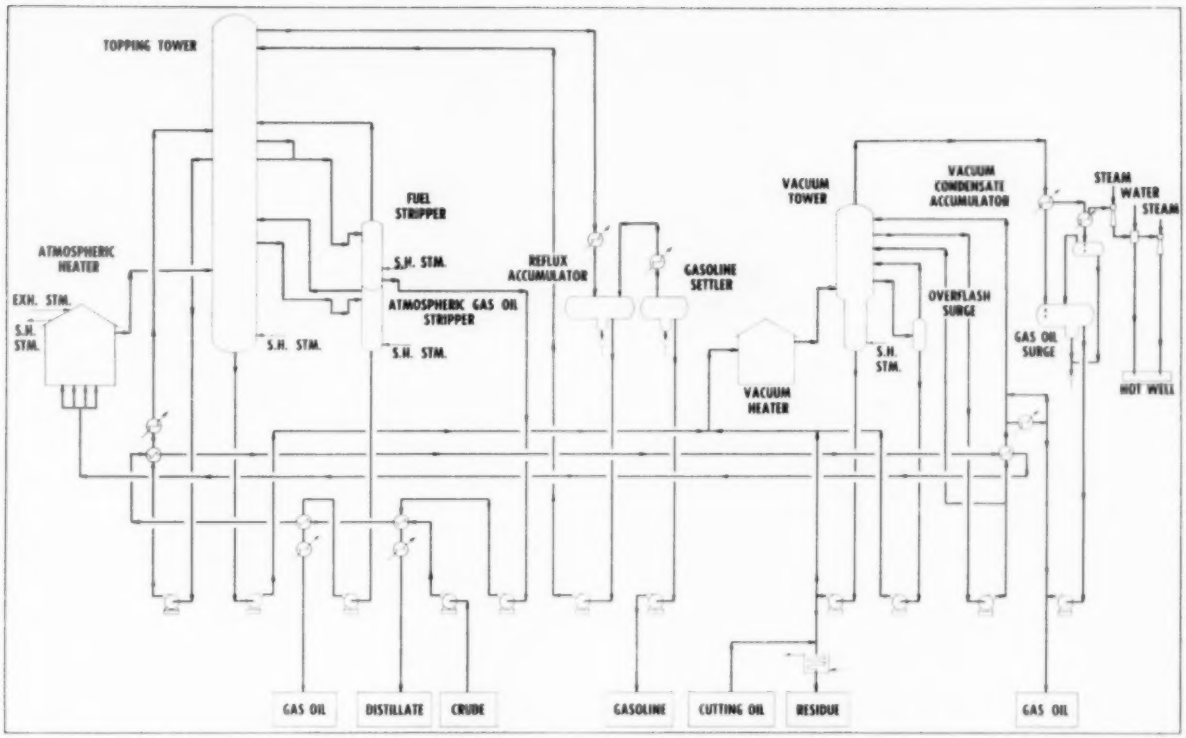
Cat cracker . . . Suntide's F.C.C. unit is designed for a gas-oil charge of 12,500 bbl. per stream day at 75 per cent conversion rate. The design coke burning capacity is 17,500 lb. per hour, and debutanized gasoline output is 6,660 bbl. per stream day.

The unit is an elevated reactor type with a pressurized regenerator. It is somewhat unusual in that the reactor is supported by one of the catalyst-storage hoppers. The reactor is provided with a centrally located internal catalyst stripper for steam stripping of spent catalyst.

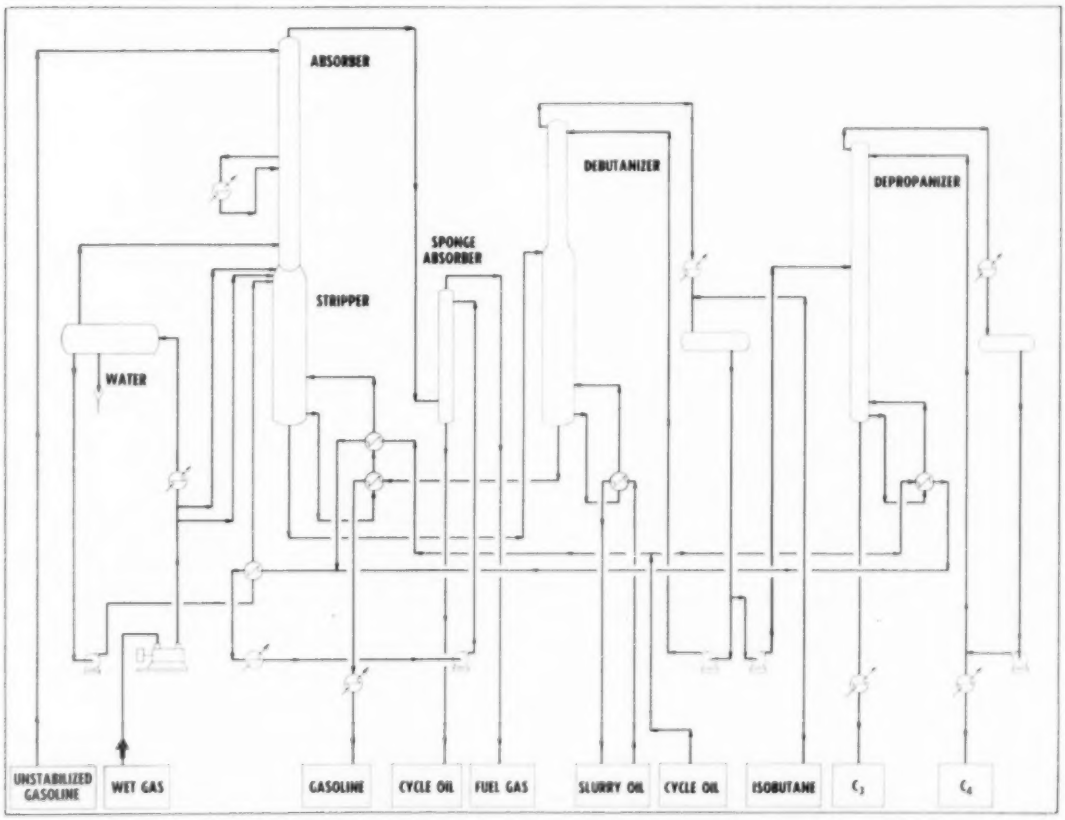
Unit flow . . . Combined raw-oil charge



SCHEMATIC FLOW CHART for fluid catalytic cracker. Unit is designed for gas-oil charge of 12,500 bbl. per stream day at 75 per cent conversion.



PROCESSING SCHEME for crude distillation in Suntide refinery.



SCHEMATIC FLOW CHART of Suntide's gas-concentration plant.

and recycle mix with and carry hot regenerated catalyst to the reactor. A perforated grid distributes the incoming oil vapor and catalyst in the vessel. The cracked products enter a cyclone, where entrained catalyst is separated and returned to the catalyst bed. Vapors then go to the main fractionating column for separation of components.

Spent catalyst leaves the reactor through the stripper and enters the regenerator, where carbon is removed by combustion with air. The air is supplied by a steam-turbine-driven multistage centrifugal-type air blower. Flue gas resulting from combustion in the regenerator passes through cyclones in the upper part of the vessel which remove entrained catalyst particles and return them to the catalyst bed.

Product vapors entering the main fractionating column are separated into gas, gasoline, light and heavy cycle oil.

Vapor recovery . . . This unit was designed for the separation of the products produced in the cat cracking unit. Feed to the unit is the unstable gasoline and gas from the overhead accumulator of the main fractionator in the cat cracking unit. The end products of the separation performed in this unit are debutanized gasoline, butanes, propanes, and dry gas. Tower arrangement consists of an absorber, sponge absorber, stripper, debutanizer, and depropanizer.

Wet gas feed is compressed and recontacted with both the bottoms from the main absorber and the vapors from the stripper. Vapors from the contacting drum are fed to the absorber tower which utilizes unstable gasoline as the absorption medium. The absorber tower is provided with one gravity-flow intercooler.

Sponge absorber . . . The gas from the absorber tower is fed to the sponge absorber which utilizes a cooled cycle oil from the F.C.C. unit. Fat oil from the sponge absorber is returned to the main fractionator in the F.C.C. unit for stripping. Overhead from the sponge oil absorber is the net fuel-gas make.

The liquid from the contacting drum is pumped into a reboiled stripper. The principal function of the stripper is to operate as a deethanizer.

Bottoms from the stripper are then sent to a conventional debutanizer and depropanizer for separation into gasoline, butanes, and propanes.

Heat requirements . . . The debutanizer reboiler utilizes slurry oil from the F.C.C. unit as the hot medium. The remaining heat requirements for this unit are obtained from a circulating

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reflux stream of the main fractionator in the F.C.C. unit. The heat which this stream supplies is for reboiling the depropanizer, a portion of the load required for reboiling the stripper and for preheating the feed to the stripper. The flow of this hot medium is such that the depropanizer reboiling and stripping reboiler operate in parallel.

That portion going through the stripper reboiler is divided, a portion being used as sponge absorber lean oil after being utilized as stripper-feed preheat and then being further cooled with water. The portion not going through the stripper-feed preheater combines with the sponge absorber bottoms and the return from the depropanizer reboiler, and this entire combined stream is returned to the main fractionator in the F.C.C. unit.

Heat requirements for the stripper not supplied by the circulating reflux stream are obtained by cooling the debutanized gasoline in a separate reboiler before going to the gasoline product cooler.

Provision has been made for charging isobutane, ahead of the depropanizer, in excess of that produced in the cracking unit to supply the demand required in the alkylation unit. Purpose of this provision is that purchased isobutane may be dried before charging to the alkylation unit.

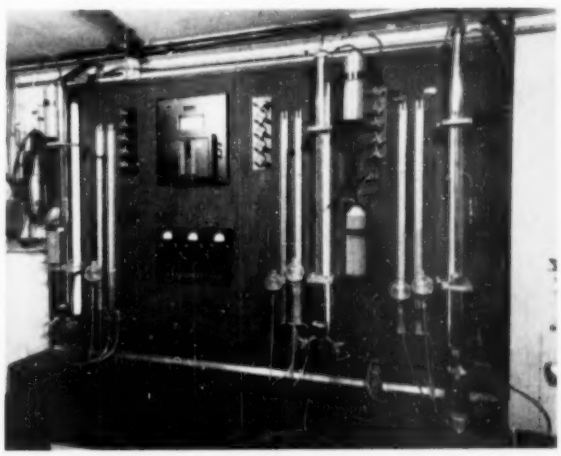
HF alkylation . . . In the HF operation, butane-butylene from the F.C.C. unit and purchased isobutane are charged under depropanizer pressure to the alkylation unit.

The charge and isobutane recycle are premixed before being charged to a water-cooled contactor. Contactor effluent is charged to a stripper, which removes the residual hydrofluoric acid and part of the recycle isobutane as overhead. This produces an HF-free bottoms for further fractionation into acid-free recycle isobutane, normal butane, light (aviation) alkylate, and heavy (motor) alkylate.

The small amount of polymer formed in the reaction is removed by fractionation in a regeneration column. The regenerated acid is returned along with a small amount of recirculated HF, and the stripper overhead is recycled to the contactor. Propane is removed by charging part of the isobutane recycle to a depropanizer.

Suntide's unit was designed for the production of a light alkylate of a quality which, when blended with 95 per cent isopentane, will meet 115/145 performance - number aviation - gasoline specifications.

Propylene tetramer . . . The tetramer



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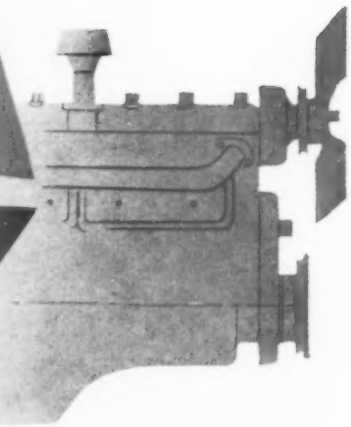

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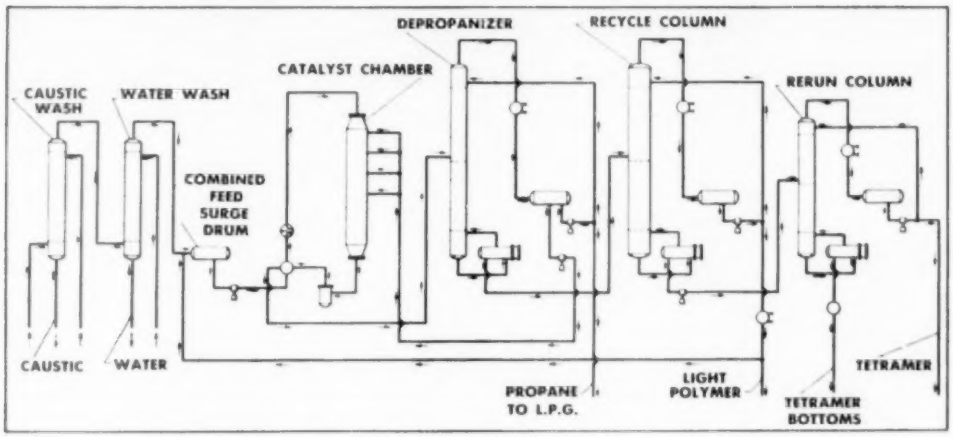

PROPYLENE TETRAMER UNIT has charge capacity of 1,135 bbl. per stream day.

unit has a charge rate of 1,135 bbl. per stream day. Charge stock containing 63 per cent propylene is first caustic-washed for sulfur removal, then water-washed to remove nitrogen compounds, after which it is mixed with recycle stock and charged to the catalyst towers. C_3 dimers and trimers are recycled to the unit for further polymerization to the tetramer.

The combined feed is first passed in heat exchange with the effluent from the catalyst towers, then is further heated and finally passed as charge to the catalyst towers, where conversion to tetramer is effected.

Effluent from the catalyst towers goes through the effluent exchanger into a depropanizer. Residual propane is taken overhead practically olefin free. A portion of the overhead is used as quench in the reactor to control temperature. Bottoms from the depropanizer are sent to the recycle tower, where lighter polymers are taken overhead and recycled as noted. A portion of the light polymers is withdrawn to storage. In tetramer operation, it is not economical to recycle the light polymer to extinction.

Bottoms from the recycle tower are further fractionated in the tetramer rerun tower, where finished tetramer is removed. The rerun tower is necessary because a small quantity of heavier bottoms is produced in the polymerization. Finished tetramer has a boiling range of 370°-390° F.

Treating . . . The treating facilities at the refinery consist of caustic-washing of several of the product streams. Storage for fresh caustic and dilute caustic are provided, and the storage tanks are so manifolded that caustic of various strengths can be supplied to the caustic washers. The following products go through separate caustic-wash tanks: straightrun gasoline from the crude unit, catalytically cracked gasoline from the vapor-recovery section, and diesel oil

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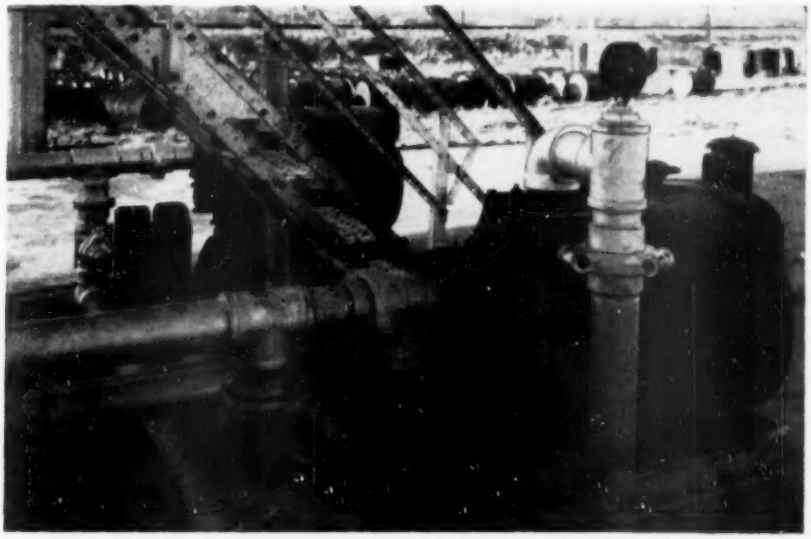

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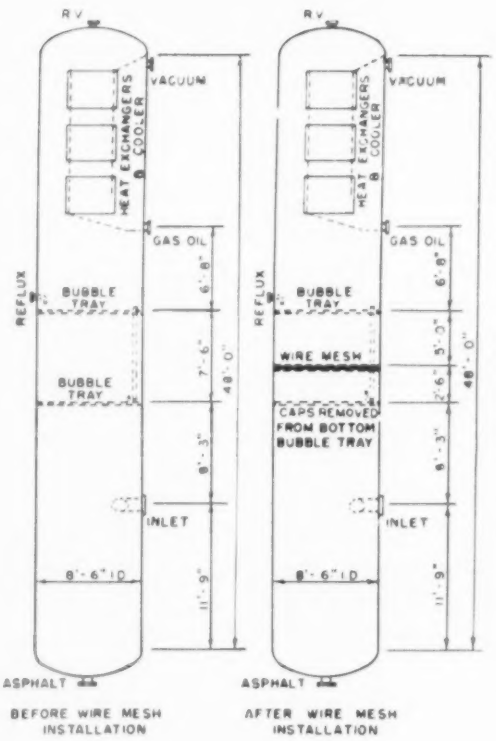
ENTRAINMENT ELIMINATION GIVES 31% CAPACITY INCREASE

OBJECTIVE:
To increase throughput capacity in an 8 ft., 6 in. diameter asphalt vacuum still.

PROBLEM:
Due to asphalt entrainment, the carbon content of the gas-oil at feed rates above 3200 bbl. per day was too high for satisfactory cat-cracker operation.

SOLUTION:
A single 4" thick Yorkmesh Demister, installed below the top bubble tray, eliminated substantially all of the asphalt entrainment.

RESULTS:
Throughput was increased from 3200 to 4200 bbl. per day (31% increase) while producing equivalent or better quality gas-oil and asphalt.



Note: For the full story of how this single 4" Yorkmesh Demister pad increased tower capacity 31% while improving quality, send for case study #1001

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from the crude unit. Propane from the tetramer unit is dried utilizing flaked caustic driers.

Spent caustic is neutralized with flue gas from the F.C.C. unit before being disposed of.

A standard TEL blending plant completes the treating facilities.

Tankage, etc. . . . The storage facilities for the plant consist of approximately 50 tanks having 1,400,000 bbl. capacity for crude and products, and 160,000 bbl. of rundown capacity.

Steam requirements are met with three boilers, each with 75,000-lb. per hour capacity. A 30,000-g.p.m. cooling tower serves the plant with an additional 4,000-g.p.m. tower for the alkylation unit.

Future expansion . . . Plant layout of the processing units was such as to provide space immediately adjacent to each unit for a future installation of an identical or similar unit. Thus the crude unit, F.C.C. unit, and alkylation unit are adjoined by vacant plots for this purpose.

In constructing these units, stub ends and ticins were provided for the various pumps and headers which would be required in an expansion program. In like manner, provisions were made to increase boiler capacity.

Gravity loading . . . Location of the plant proper is on a bluff above Nueces Bay and has lent itself to the utilization of gravity operations in both car and truck loading and skimming operations. In the latter case, an oil separator is provided to initially receive waste water. After passing through this installation, the water then enters the first of two skimming ponds, which are arranged in stair-step fashion on the side of the bluff.

The water passes down through the two ponds by gravity, while the oil is skimmed off the surface and run to slop tanks.

Meanwhile, product tanks are all located on the bluff, while the truck-loading and car-loading racks are on a much lower level. Consequently, it is a simple matter to take advantage of gravity feed in loading operations.

The complete plant was engineered and constructed by Lummus Co., of New York, in 18 months. Adverse conditions prevailed, including steel strikes and other difficulties. Due to plant design and company cooperation, the plant will be operated with fewer than 200 employes. Plants of this kind sometimes require 350 employes.

Suntide Refining Co. is an affiliate of Sunray Oil Corp., Tulsa.

Visbreaking

(Continued from page 168)

and gas are further processed in an absorption and stabilizer section. The light gas oil is used for either heating oil or viscosity blending, whereas the heavy gas oil from the fractionator and gas oil from the flash tower that is not used as quench and reflux are further processed in the fluid cat cracker.

Coke formation is inherent in this process but there are several variables which may be controlled to minimize this formation and counter the effects after the formation has occurred. Minimum laydown of coke in the furnace tubes is controlled by high velocities created by the injection of water to the coil inlets. Localized "hot spots" have been reduced by this operation, and those that do occur are controlled by regulating the furnace fires.

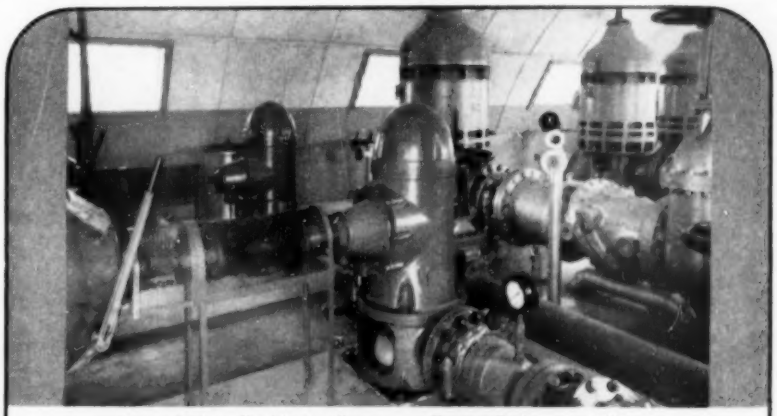
Water injection . . . The use of water injection in this particular unit has also meant an increase in heat-transfer rate in the furnace. The coating of carbon on the inner walls of the transfer lines is held to a minimum by the velocity created by the steam from the furnace coils and from the vaporized portion of the quench oil.

Severe coking can be detected in the furnace tubes by measuring the increase in skin temperatures of the tubes at strategic points. Plugging of the bottom drawoff of either the evaporator or the flash tower indicates a substantial buildup of coke in the tower.

The analysis of the fuel oil for per cent sediment by extraction is used quite extensively as a means of detecting the amount of carbon formed in the visbreaking process and as a measure of the severity of cracking. An increase in the suspended carbon indicates that difficulty can be expected in the evaporator and flash-tower section.

The furnace outlet temperature for this particular unit is controlled by the rate of coke deposition and the sediment of the fuel oil. The asphalt content and gravity of the visbreaker charge will govern the temperature at which carbon laydown becomes excessive. Water injection will allow higher transfer temperatures for any given charge stock, and consequently, less yield of Bunker C or No. 6 fuel oil.

On the startup of the unit, the system is purged with steam and gas oil is then added to start circulation. The temperature of the gas oil is increased to about 700° F. This requires less than 4 hours. Hot vacuum-tower bottoms are gradually added to the charge, while at the same time the gas oil



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quantity is reduced. Temperatures are then raised to cracking conditions. Approximately 8 hours are required to bring the unit to maximum flow rate and temperature.

Shut down . . . In shutting down the unit, the heat input to the furnace is reduced until the coil outlet reaches 650° F., at which time the fires are completely extinguished and gas oil added to the system to flush out all residue. Steam followed by a water wash is then used to prepare the unit for decoking and repairs.

To shut down the unit and prepare for maintenance requires an average of 12 hours.

Continuous runs of 60 to 90 days have been possible by the methods already mentioned and by the installation of equipment whereby each furnace may be removed from service for decoking without a complete shutdown of the unit. This is possible by the use of positive-closing valves on the furnace transfer lines. The flash tower can also be cleaned without a unit shutdown, which is again possible by utilizing positive-closing valves. Fuel-oil pumps may likewise be repaired during operation.

Increased service factor is also possible by faster maintenance turnarounds of the unit. One particularly time-consuming operation was the installing and removal of blinds on the shutdown and startup of the unit. Eastern States has installed quite a number of the swing-type blind and flange sets on this unit, which enables one man to blind off a line in about 10 minutes, whereas the conventional type blind and flanges required the use of three men for about 40 minutes.

All lines, coolers, and vessels where the deposition of carbon is likely to occur have been connected to a gas-oil flushing system which has given a much longer service factor and less maintenance work on shutdowns.

The close coordination of operating and maintenance personnel has enabled us to reduce the time consumed in decoking and repairing the unit to about 80 hours.

The steps taken to prevent corrosion from the high-sulfur charge stock have been primarily those of selecting proper materials of construction. The evaporator and fractionator are lined with 11-13 chrome-type 410 alloy. The top three trays of the fractionator are monel and the tubes used in the fractionator overhead condenser are of admiralty metal. The vapor line from the evaporator to the fractionator is lined with 11-13 chrome. Ammonia is also injected into the fractionator for corrosion control.

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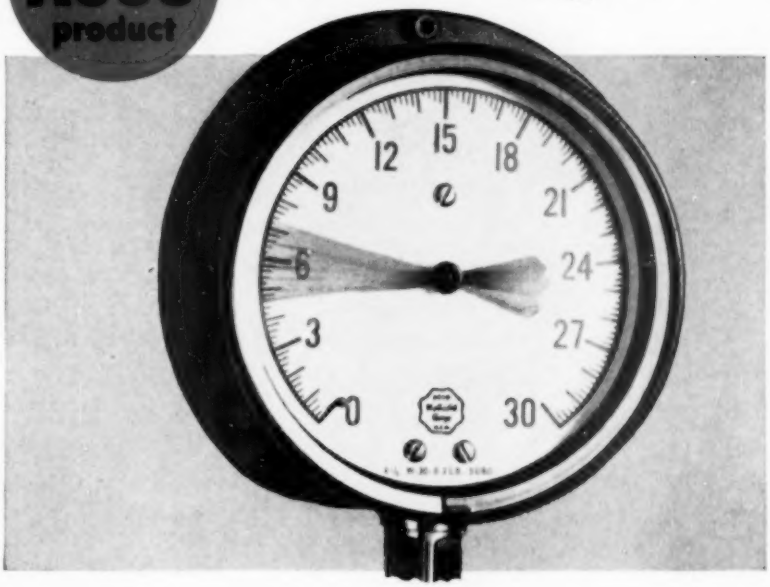

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COMPACTNESS OF UNIT may be seen in this view with vapor-recovery section at left, storage hoppers in center, and regenerator, reactor, and fractionator at right.

MODEL IV CAT CRACKER BRINGS

Lower Investment, Plus More Efficient Operation

to Pan-Am Southern at Destrehan

by F. Lawrence Resen
Gulf Coast Refining Editor

THE new Model IV fluid catalytic cracking unit has been on stream for more than a year at Pan-Am Southern Corp.'s Destrehan, La., refinery. Licensed by the Standard Oil Development Co. and designed and constructed by Lummus Co., this unit exhibits a number of features which permit lower initial investment and a more simplified and stable operation.

These features include: A catalyst transfer system which utilizes in a unique manner differential static heads to move catalyst from regenerator to reactor.

Lower over-all unit height due to the high efficiency of the catalyst transfer system and novel equipment arrangement.

Elimination of conventional slide valve throttling with catalyst circulation controlled principally by density differentials.

Employment of a simplified catalyst-recovery system consisting of two stages of cyclones in reactor and regenerator.

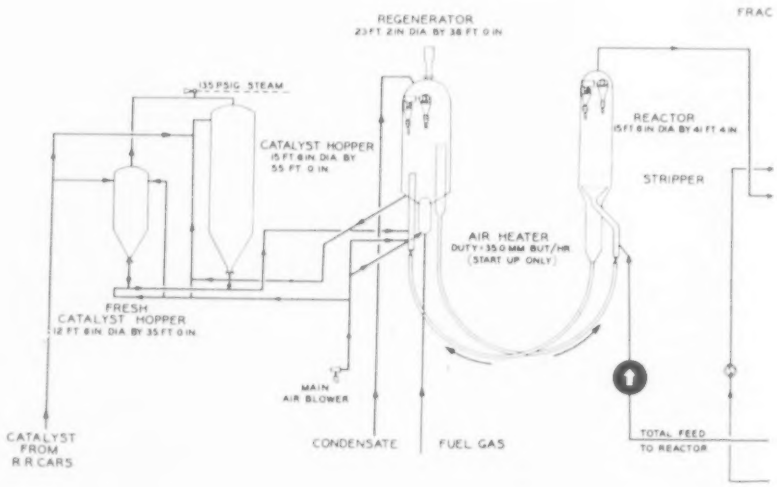
Smaller and more efficient vessels operating at higher gas velocities but still without excessive catalyst loss.

The new catalyst-transfer system contributes to a lower unit profile which is further diminished through the use of high superficial gas velocities resulting in a smaller reactor and regenerator. Savings in steel requirements and in maintenance are thus obtained by this more compact unit and its compactness also contributes to simpler operation.

An 11,000-bbl. per day unit of this design has been in operation at the Edmonton, Alta., refinery of Imperial Oil, Ltd. The Pan-Am Southern unit at Destrehan is the first Model IV cat cracker to go into operation in the United States. Initial onstream date at Destrehan was November 21, 1952. Since that time, the unit has been operated with a relatively high number of down times, a situation not uncommon when the initial units of a new-type series are placed on stream. Operating data given here represent average fresh feed charge amounting to 14,300 bbl. per stream day at average conversion of 56.3 per cent. Detailed data are given in Tables 1-3.

Unit Description

Fig. 1 indicates flow in Model IV cat cracker, the cat fractionator, and gas-concentration plant.



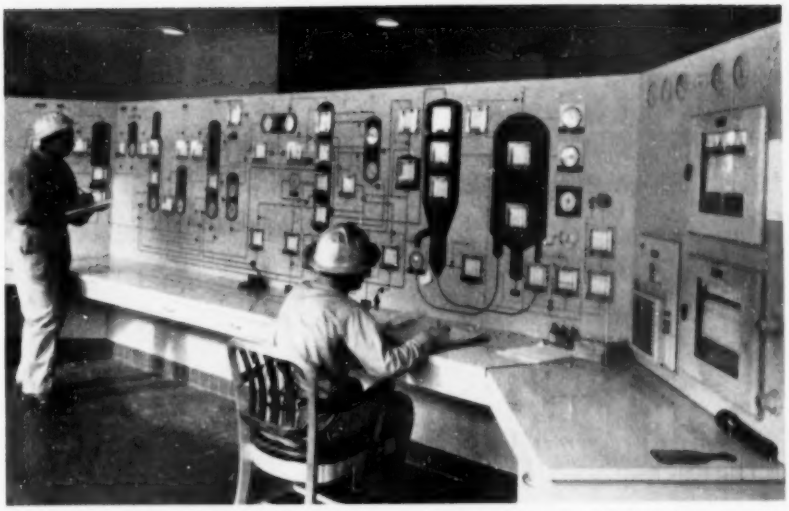
MODEL IV CAT-CRACKER setup at Destrehan, La., refinery of Pan-Am Southern Corp. Feed-preparation unit, cracker, regenerator, and gas-plant facilities are shown. Fig. 1.

Catalyst transfer . . . Spent catalyst is transferred from the bottom of the stripping section in the reactor through a 2-ft. line into the spent-catalyst riser. This dense-phase riser extends up through the grid into the regenerator bed. It is equipped with a flat baffle plate supported over its outlet to distribute the catalyst as it enters the regenerator.

Regenerated catalyst is withdrawn from its bed by overflowing into the regenerator standpipe. Thus, the elevation of the overflow well above the bottom tangent line of the regenerator sets the fluid bed depth. The regenerated catalyst loop has a larger outside diameter than the spent catalyst loop, being lined internally with refractory for handling hot catalyst.

Regenerated catalyst flows into its loop which carries it to the reactor oil riser and into the main body of the reactor. Preheated liquid feed is injected into the hot fluid-catalyst stream through 2-in. injection nozzles located in the charge-oil riser, whereupon the feed vaporizes and enters the reactor in this state.

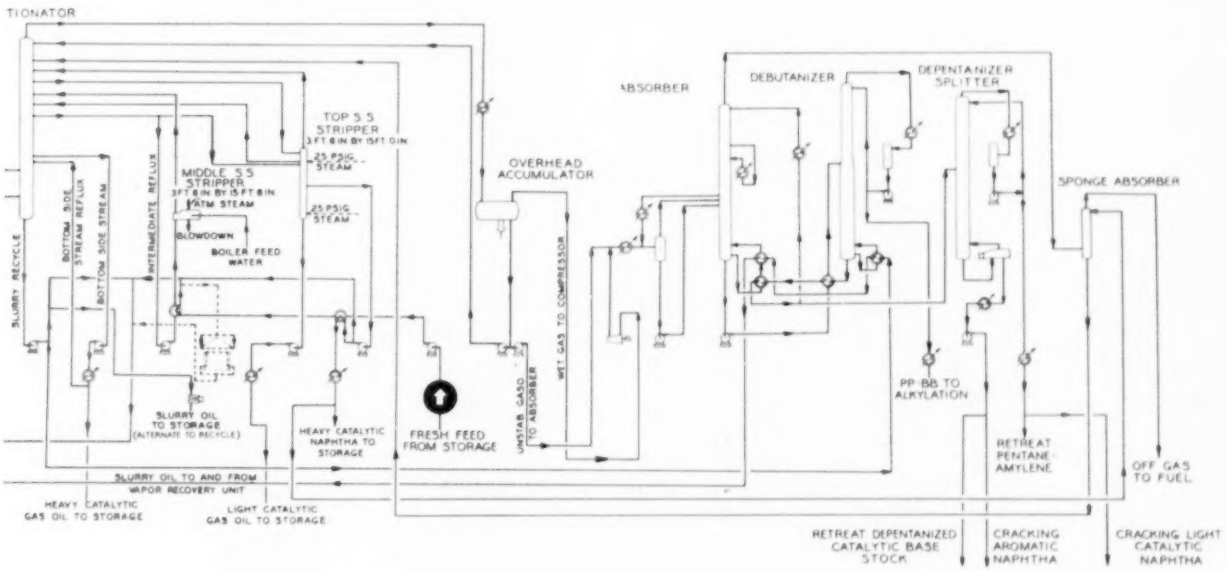
No slide-valve throttling . . . Each of the U-bends between regenerator and reactor is equipped with a single slide valve just before it ties onto its individual riser, namely, the regenerator dense-phase riser and reactor charge-oil riser. However, these valves are not used for continuous throttling and hence the conventional hydraulic slide-valve control system is eliminated. Emergency closure of slide valves is effected by use of 100-psig. air. Normally, the valves operate wide open although they can be set in any position. Operating with no appreciable pressure drop, slide-valve erosion will not limit length of run. Thus, a single valve can be used in each circuit with assurance that positive shutoff can be obtained at end of run.

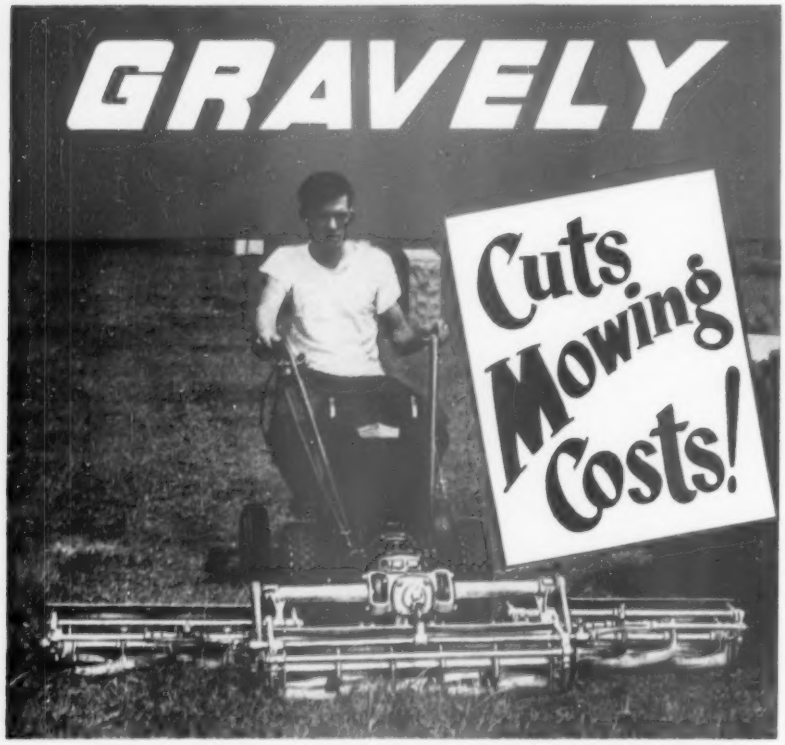


CONTROL BOARD of Model IV unit shows catalyst-transfer lines and their loop arrangement. Regenerator is large vessel at right.

Flow of catalyst from regenerator back to the reactor is accomplished by the differential in static head between the regenerator and reactor. As the catalyst is withdrawn from the regenerator bed by overflowing into the standpipe, it is in the dense phase, and continues as such within the loop until it reaches the oil feed-injection point located just above the slide valve. At this juncture, the catalyst phase changes from dense to dilute and it is this change in density plus the static head differential which causes the catalyst to flow in this direction.

Catalyst circulation control . . . Meanwhile, spent catalyst flows from the reactor through the spent-catalyst loop in the dense phase until it enters the dense-phase riser to the regenerator, where lift air is employed to carry the catalyst upwards. Under normal operating conditions, this lift air controls the actual catalyst circulation between the vessels. By varying the lift-air rate, the amount of catalyst withdrawn per unit time from the reactor is regulated and also the flow of catalyst from the regenerator to the reactor. Reactor temperature will thus be affected in turn. Changes in circulation rate over wider than normal ranges may be accomplished by variation of vessel differential pressure or adjustment of slide-valve setting. As with more conven-





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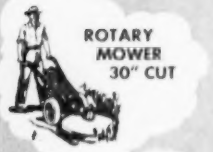

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tional units, control of reactor temperatures by adjusting circulation rate is a vernier control that becomes effective when the major heat-balance components are in approximate balance.

Pressure control on the regenerator is effected through the stack slide valve, which maintains desired differential pressure between the reactor and regenerator regardless of surges in other parts of the unit, such as in the vapor-recovery or fractionating sections. The 30-in. control valve in the vent stack is equipped with a 16-in. orifice which takes the main pressure drop from the regenerator. Two fixed orifice plates are located above the valve to absorb additional pressure drop.

Gas velocities . . . A most interesting phase of the Model IV unit has been the high superficial gas velocities in both the reactor and regenerator. While conventional units have been designed with velocities from 1.2-1.5 ft. per second, this unit operates with velocities around 2.5 ft. per second. Thus, the size of the vessels has been reduced to the extent that the regenerator is 23 ft. 2 in. in diameter and 38 ft. high, while the reactor is 15½ ft. in diameter by 41 ft. 4 in. high, exclusive of stripper.

Catalyst loss . . . No catalyst loss is attributable to the higher vessel velocities. For instance, during an 18-day period, catalyst loss averaged 4 tons per day while circulating at the rate of 20-22 tons per minute. (See Fig. 2).

The low catalyst loss at high cyclone loadings is explained by:

1. The increased entrainment due to the higher velocities consists primarily of coarse particles which are recovered in the first cyclone stage operating at essentially 100 per cent efficiency.

2. The increased loading to cyclones markedly increases efficiency of collection of each particle fraction, for the greater the number of particles, the more chance of entraining fines being collected by mass action of coarser particles.

Particle-size distribution of the catalyst bed finds the 0-40μ fraction averaging 1-2 per cent by weight, the 40-80μ fraction about 60 per cent by weight. This was for a 6-week period. (See Fig. 3).

Catalyst recovery . . . Both reactor and regenerator are equipped with two-stage cyclone systems which function satisfactorily with the high vessel velocities as noted. The reactor has three sets of the two-stage cyclones, while the regenerator has four sets.

An interesting feature of the recovery systems are the modified diplegs

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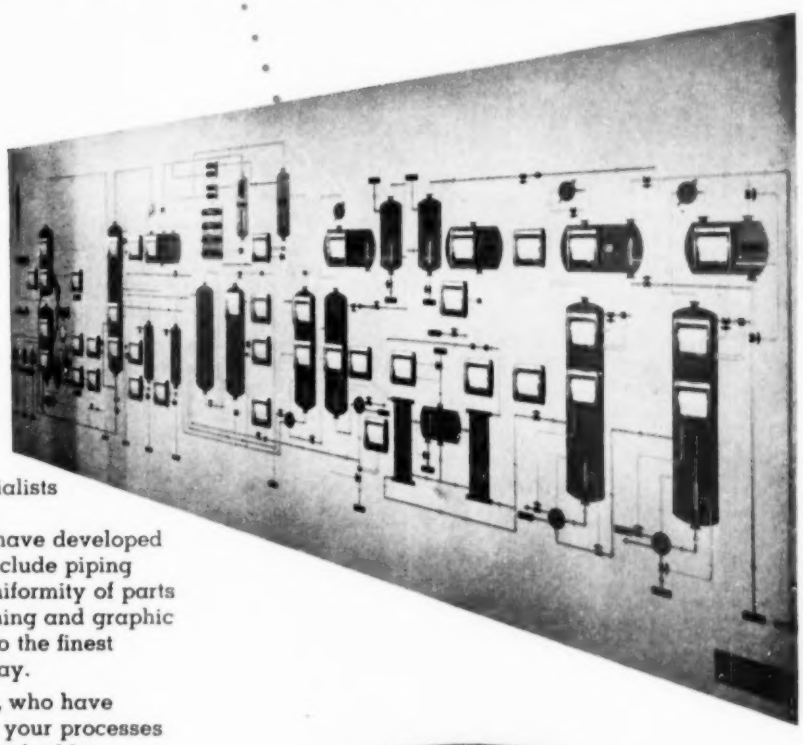

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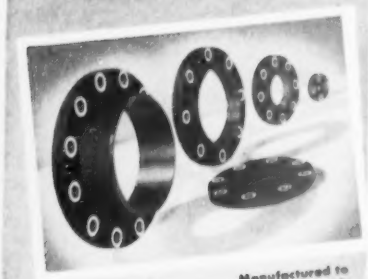

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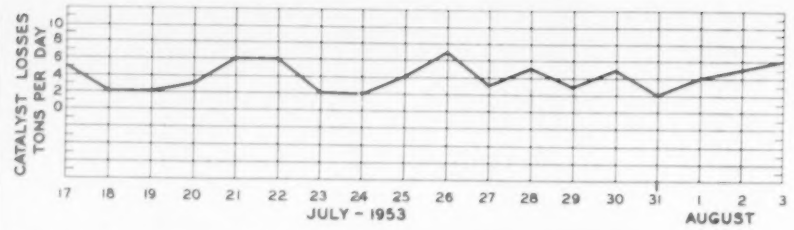
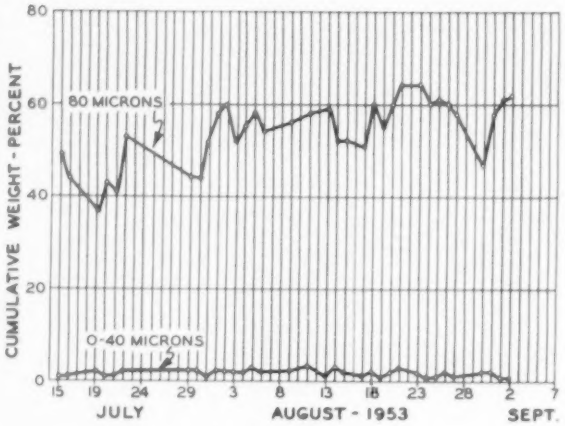


LOW CATALYST LOSS has been one of the features of Model IV operation to date. Loss for a 15-day period averaged 4 tons per day while circulating 20 to 22 tons of catalyst per minute. Fig. 2.



PARTICLE-SIZE distribution curve for catalyst in bed shows 0-40μ fraction averages 1 to 2 per cent by weight. The tutes 60 per cent by 40-80μ fraction consti- weight. Fig. 3.

which return catalyst from cyclones to the bed. On the primary diplegs, it was felt that the solid baffle plate support just below the dipleg outlet might possibly clog up if it were located too close to this outlet. At the same time, locating it a greater distance from the outlet tended to diminish its effectiveness. A compromise was effected by using a doughnut baffle located about 6 in. below the bottom of the dipleg.

The primary baffle plate now consists of an 18-in.-diameter steel plate with a 4-in.-diameter hole in the center, the complete doughnut unit being suspended from the bottom of the primary dipleg. Most of the catalyst dropping through the dipleg hits the plate, and the opening prevents accumulation of catalyst below the dipleg which could result in its being clogged.

Flapper valves . . . An alternative meth-

TABLE I—OPERATING CONDITIONS

	Selected week		
	1	2	3
Comb. feed to react., °F.	371	346	357
Reactor temp., °F.	922	922	915
Reactor pressure, psig.	9.1	9.0	9.0
Cat. circ., T/M	21.5	22.1	23.0
C/O ratio	13.03	13.45	14.38
W.H.S.V.	1.15	1.213	1.216
Slurry recovery, bbl. per stream day	721	679	915
C/O, W.H.S.V.*	11.33	11.08	11.84
Stripping steam, lb. per hour	7,950	8,250	8,257
Reg. dense phase temp., °F.	1,107	1,105	1,080
Reg. pressure, psig.	11.7	10.8	10.6
Reg. velocity, F.P.S.	2.26	2.38	2.4
Flue gas:			
Per cent CO_2	10.0	10.1	8.3
Per cent O_2	1.2	0.9	0.5
Per cent CO	7.0	7.4	7.2
Process air, M.s.c.f. per hour	1,761	1,785	1,780
Catalyst inspection:			
Carbon on reg. cat., wt. per cent	0.52		0.60
Carbon on spent cat., wt. per cent	1.0		1.1
Activity, Indiana relative	21		
Particle-size analysis, per cent:			
0-20μ and 20-40μ	2	1	1
40-80μ	58	59	63
80μ+	40	40	37
Total fresh feed charged during week, bbl.	101,500	100,000	98,651
Conversion on fresh feed:			
(1) 100 minus volume per cent gas oil	56.7	56.7	61.1
(2) Corrected	54.4	57.2	57.3

*Weight-hour space velocity.

od used on the secondary diplegs was the installation of flapper valves, operating in the usual manner to allow normal flow of catalyst downward but closing when surges of pressure within the vessel tend to force catalyst back out the cyclone. The second diplegs terminate at an angle so that catalyst passing downward through the dipleg is diverted against the flapper valve.

The flapper valve is so spaced that with no or very little catalyst passing through the dipleg, a small opening remains between the bottom edge of the leg and the valve. As flow of catalyst increases, it forces the valve open to its normal position. In the event of a sudden increase of pressure within the vessel, however, the valve is forced tightly against the edge of the dipleg, closing it off until such time as a balance is again achieved in the vessel. A baffle plate is suspended below the end of the dipleg for distribution of catalyst.

Upon installation, there were some doubts as to whether or not the flapper valves would hold up more than 90 days under normal operating conditions. However, the most recent check found them functioning satisfactorily after 5 months' service with no failure anticipated in the near future.

Unit profile . . . A characteristic of the Model IV unit is its low unit profile which results in a considerable savings in construction costs. For instance, the top of the regenerator at Destrehan, exclusive of stack, is 94½ ft. above grade while conventional units of comparable capacities would require the regenerator top to be about 130 ft. above grade. Savings are achieved in lower structure costs as well as in the elimination of an elevator for personnel use during operation and turnarounds.

The profile, and corresponding initial cost of the unit, is influenced by a number of factors:

1. U-bends: Use of the U-bend loops and elimination of standpipe slide valve throttling result in more efficient utilization of driving forces with practically no standpipe buildup wasted in pressure dissipation across slide valves.

2. Slide valves: Height is added to conventional units by space required for dual slide valves and injectors. This space requirement is eliminated and hence does not contribute to unit height.

3. Dense-phase spent riser: The design of the dense-phase riser to terminate the low-pressure zone near the top of the regenerator bed permits bypassing the vessel cone and grid and part of the high-density bed. Consequently, this results in a reduction in height required for the spent-catalyst standpipe.

TABLE 2—CHARGE AND PRODUCT FLOWS

	Bbl. per stream day	M.s.c.f. per day	°A.P.I.	Sp. gr.	Lb./gal.	Lb./hr.	Wt. %
First week:							
Gas oil	14,500		28.7		7.355	186,900	96.38
PP-BB from coker	196				4.80	1,645	0.84
Flushing oil	418		28.7		7.355	5,380	2.78
Total charge	15,114					193,925	100.00
Lt. cat naphtha	5,168		54.1		6.347	57,400	29.58
PP-BB	2,310			M.W. 53.1	4.760	19,250	9.92
Off-gas		5,860		M.W. 28.3		18,210	9.42
Lt. cat gas oil	4,720		28.3		7.373	60,800	31.38
Hvy. cat gas oil	1,549		20.2		7.768	21,100	10.86
Coke (inc. 12% H_2)						10,408	5.35
Flushing oil	418		28.7		7.355	5,380	2.78
Total yield						192,548	99.29
Loss						1,377	0.71
Second week:							
Gas oil	14,500		29.1		7.337	186,000	97.2
Flushing oil	420		29.1		7.337	5,390	2.8
Total charge	14,920					191,390	100.00
Lt. cat naphtha	3,980		51.7		6.430	44,700	23.40
Pentane	708		60.6		6.132	7,600	3.96
PP-BB	2,465			M.W. 53.88	4.832	20,800	10.86
Off-gas		6,240		M.W. 26.73		18,300	9.57
Lt. cat gas oil	4,734		28.1		7.383	61,100	31.90
Hvy. cat gas oil	1,521		20.4		7.757	20,700	10.82
Coke (inc. 11.6% H_2)						10,856	5.67
Flushing oil	420		29.1		7.337	5,390	2.80
Total yield	14,078					189,446	98.98
Loss						1,944	1.02
Third week:							
Gas oil	14,093		30.8		7.259	179,027	95.66
Stab. gas from F.H.F.		154.4		M.W. 41		696	0.37
PP-BB from crude unit	200				4.896	1,714	0.92
Flushing oil	450		30.8		7.259	5,716	3.05
Total charge						187,153	100.00
Lt. cat naphtha	5,478		57.8		6.223	59,657	31.88
PP-BB	2,515			M.W. 52.51	4.726	20,800	11.11
Off-gas		5,830		M.W. 25.5		16,340	8.73
Lt. cat gas oil	4,192		30.4		7.275	53,391	28.53
Hvy. cat gas oil	1,288		25.7		7.495	16,894	9.03
Coke (inc. H_2)						9,978	5.33
Flushing oil	450		30.8		7.259	5,716	3.05
Total yield						182,776	97.66
Loss						4,377	2.34

Other savings . . . Reduction in costs have also been affected in the Model IV unit as a result of:

1. Vessel design: The decreased vessel sizes resulted in a direct savings in materials, labor and construction costs.

2. Intergral auxiliary burner in regenerator: The auxiliary burner used in the regenerator air system was constructed as an integral part of the regenerator. This eliminated the otherwise necessary hot air piping and airline expansion joints as well as the need for a separate supporting structure for the burner.

3. U-bends: Use of U-bends for catalyst transfer and dense phase in spent riser permitted design with transfer lines smaller than for a conventional unit, thus minimizing expansion problems in addition to reducing piping costs.

4. Slide valves: Elimination of slide-valve throttling resulted in material savings, while slide valves incorporated in unit do not require expensive hydraulic system for operation.

5. Main air blower: Since the main regeneration air stream is not used for transporting catalyst, a lower air blower-discharge pressure is made possible. In addition, the flexibility needed in blower-discharge pressure for a conventional unit to compensate for varying catalyst circulation rates is not required on this unit.

6. Ease of operation: All air, stripping steam, and oil injectors are located on the first platform about 15 ft. above grade. Thus, all operating

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Winslow Discovery Stops Sludge Show!

Oily Critics Amazed by Performance!

GETS TOP BILLING IN FILTER FROLICS

by hedda lettuce

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It looks like a long term contract for "Cee Pee" with the industry. No one here has seen anything like her since Cecil B. DeMillwheel presented Veri Viscosity back in 1923.

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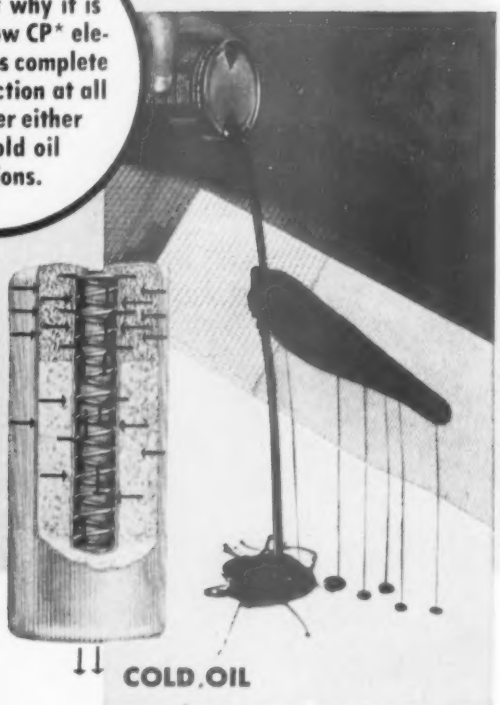

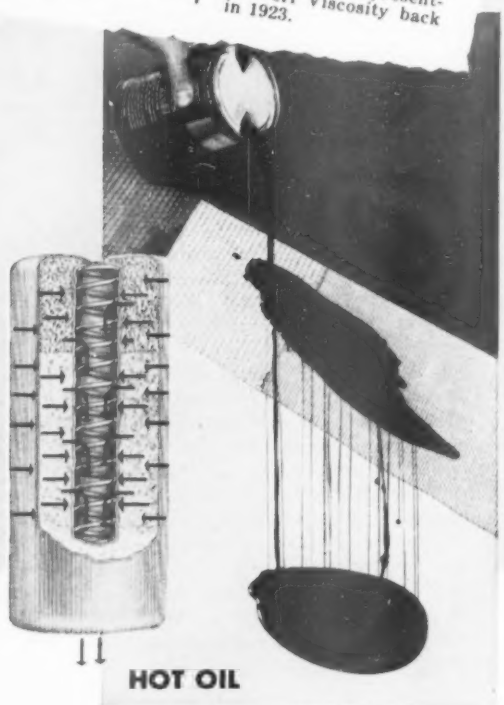

PHOTOGRAPHS C

Cold oil is poured over both portions of the screen. As can be seen the entire surface passes oil, with the majority going through the less dense section. There is no excess left.

In a Winslow CP* element there are also two sections, one more dense than the other. The less dense section is a very small portion of the entire assembly'''. Under COLD OIL conditions the Winslow CP* element reacts exactly as is shown in the screen test.

Under pressure the cold oil is all filtered. Dangerous particles are filtered out so that the engine is protected even under COLD OIL conditions. There is no unfiltered oil left to activate the by-pass. In a Winslow CP* element the by-pass acts *only* as a safety valve.

Under HOT OIL conditions the Winslow CP* element reacts exactly as is shown in the screen test. The less dense portion is still filtering some oil but the dense portion is taking more and more—automatically controlling pressure losses, as oil viscosity dictates.

Under HOT or COLD oil conditions *complete filtering of all the oil* is assured for within a single full-flow element the Winslow CP* performs as both a full-flow and a shunt-filter.

'''Strict field and lab tests have proved that even the less dense section of a CP* element will remove all particles of a harmful nature.

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controls are easily accessible, and this combined with over-all low profile eliminates need of elevator for operating or turnaround services.

Operating Data

The following data are based on average operating conditions during a 3-week period:

Virgin gas-oil feed to the reactor averaged 14,300 bbl. per stream day and the unit operated at an average conversion of 56.3 per cent on the fresh feed. Average yields on the basis of barrels per stream day were: light catalytic naphtha, 4,875; PP-BB mixture, 2,430; light catalytic gas oil, 4,549; heavy catalytic gas oil, 1,453; and flushing oil, 429.

The catalyst-oil ratio averaged about 13.5 providing sufficient heat to completely vaporize and crack the oil, with catalyst circulation rate at about 22 tons per minute.

Process Flow

The fresh feed pump takes suction on the gas-oil storage tank and discharge through the tube side of the heavy catalytic naphtha exchanger where the feed temperature is raised to 158° F., then through the intermediate reflux exchangers wherein feed temperature is raised to 245° F., and finally to the direct-fired feed preheater where it is upped to 450° F.

The preheated liquid feed is then injected into a stream of hot fluid catalyst at a temperature of about 1,100° F. through injection nozzles located in the charge-oil riser to the reactor at a point above the regenerated - catalyst slide valve.

Reactor . . . Cracking of oil feed begins when the oil comes in contact with regenerated catalyst in reactor oil riser line. The vaporized oil and catalyst mixture passes upwards through an oil riser and old feed cone, then through the distribution holes in the reactor grid which disperses entering streams of catalyst and oil vapor evenly through the catalyst bed. Cracking takes place at a temperature of about 920° F., with cracked vapors passing overhead to the fractionator.

Dimensions of the reactor are approximately 15½ ft. i.d. by 41 ft. high from top weld line to bottom weld line of main body of reactor. The plenum chamber is 8½ ft. in diameter. The shell of the stripper is in the form of a cylinder attached to the reactor bottom cone. Disk and doughnut baffles are provided in the stripper for intimate mixing of downflowing catalyst and upflowing stripping steam.

Spent catalyst flows downward from

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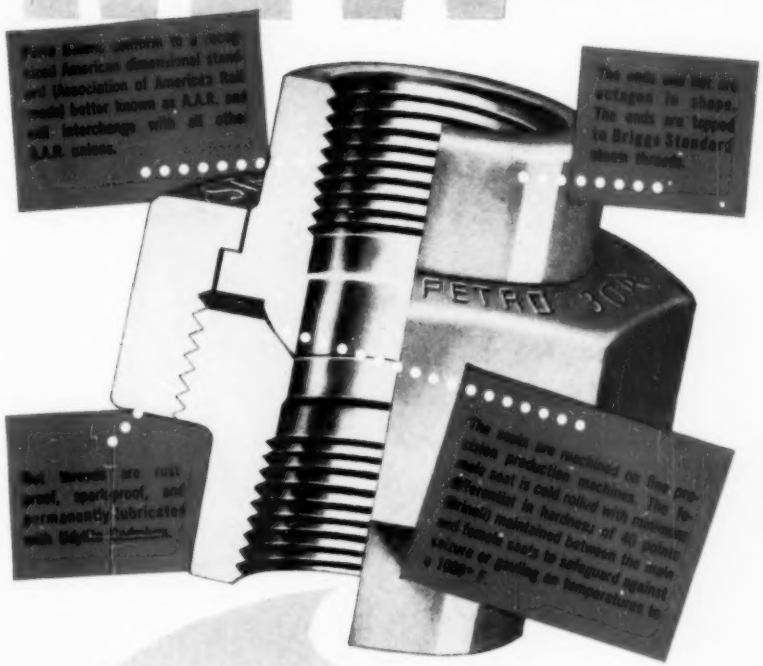

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the dense-phase bed in the reactor into the steam stripping section where 135-psig. steam is used to strip out entrained hydrocarbons. The stripped spent catalyst then flows through the spent-catalyst transfer line into the dense-phase riser where an air stream lifts it into the regenerator.

This air, entering the regenerator dense-phase riser, is employed to regulate the density of the catalyst in the riser for maintenance of catalyst flow from reactor to regenerator. The additional air, over and above this quantity of lift air, required to burn coke is discharged from the air blower into the air heater and directly into the regenerator bottom cone where it flows through a distribution grid and then into the dense bed.

TABLE 3—FEED AND PRODUCT SPECIFICATIONS

	Gas-oil feed	Slurry oil	Hvy. cat gas oil	Light cat gas oil	Light cat naphtha	Avg. base stock
First week:						
Gravity, °A.P.I.	28.7	3.0	20.2	28.3	54.1	
A.S.T.M. dist., °F.:						
I.b.p.	294		440	442	106	
10 per cent	460		642	480	134	
30 per cent	572		678	498	176	
50 per cent	626		692	526	246	
70 per cent	694		712	562	314	
90 per cent	758		740	602	370	
F.b.p.	760+		760+	636	406	
Color, N.P.A.				1.5		
Flash (P.M. closed cup), °F.				220		
R.v.p., psia.					6.8	
Conradson carbon, wt. per cent	0.074					
Cat. content, lb./gal.		0.10				
Second week:						
Gravity, °A.P.I.	29.1	2.0	20.4	28.1	51.7	60.6
A.S.T.M. dist., °F.:						
I.b.p.	280		454	413	114	108
10 per cent	468		658	448	146	144
30 per cent	570		666	494	196	182
50 per cent	632		686	528	274	236
70 per cent	682		704	561	328	268
90 per cent	720		738	612	374	286
F.b.p.	748		760+	640	420	302
Color, N.P.A.				1.5		
Flash (P.M. closed cup), °F.				198		
R.v.p., psia.					4.15	
Conradson carbon, wt. per cent	0.09					
Cat. content, lb./gal.		0.10				
Third week:						
Gravity, °A.P.I.	30.8	12.6	25.7	30.4	57.8	
A.S.T.M. dist., °F.:						
I.b.p.	230		464	420	110	
10 per cent	450		620	472	128	
30 per cent	552		652	479	162	
50 per cent	610		670	510	223	
70 per cent	670		684	536	298	
90 per cent	728		708	574	365	
F.b.p.	748		748	606	416	
Color, N.P.A.				1.5		
Flash (P.M. closed cup), °F.				192		
R.v.p., psia.					7.8	
Conradson carbon, wt. per cent	0.058					
Cat. content, lb./gal.		0.15				

TABLE 4—PODBIELNIAK ANALYSIS
(In mole per cent)

	First week		Second week		Third week	
	PB-BB	Off-gas	PB-BB	Off-gas	PB-BB	Off-gas
Inerts		14.8		13.9		19.8
C_1		29.8		34.0		33.8
$C_2=$	0.2	6.3	0.6	4.2	1.2	4.6
C_2		11.6		16.0		7.9
$C_3=$	17.8	14.3	13.9	8.3	15.8	16.6
C_3	14.7	10.2	12.4	17.8	18.3	9.3
i-C_4	28.4	1.6	23.1		30.0	
$C_4=$	28.5	11.4	39.4	2.8	26.8	5.2
n-C_4	6.0		6.3		5.1	
i-C_5	4.3		4.5	3.0	2.8	2.8

Regenerated catalyst is withdrawn from the bed by overflowing into the regenerator standpipe thence via the regenerated catalyst loop to the reactor oil riser where it meets the incoming feed charge, as noted previously.

Fractionation . . . Vapors from the reactor enter the fractionator below the bottom tray, No. 27. The fractionator is 12 ft. in diameter by 96 ft. high. Control of fractionation is maintained by bottom, intermediate, and top reflux. A bottom sidestream is withdrawn from No. 19 tray by the heavy catalytic gas-oil pump which discharges to the shell side of the feed cooler. The stream is split upon leaving the cooler with part going to storage and the rest to reflux pumps discharging through an exchanger to No. 10 tray.

For production of light catalytic gas oil, a portion of material from No. 13 tray is diverted to the middle sidestream stripper and passes downward over four trays to the bottom of the sidecut stripper where 25-psig. steam is introduced for stripping out light ends. Vapors from the stripper return to the fractionator above No. 12 tray, with net catalytic gas oil taken from the bottom of the stripper to storage.

A heavy catalytic naphtha sidecut is withdrawn from fractionating No. 7 tray and passes downward over four trays in the top sidestream stripper. Net heavy catalytic naphtha flows from the bottom of the stripper to storage with a sponge-oil stream diverted to the off-gas absorber at the vapor-recovery unit.

Fractionated overhead vapors pass through the overhead condenser into overhead accumulator with a portion of the condensate returned as reflux to No. 1 tray. Overhead accumulator serves as a gas separator from which gases (C_4 and lighter) flow to suction of gas compressors and then into vapor-recovery unit. The net condensate in the overhead accumulator is also charged to the vapor-recovery unit.

Vapor recovery . . . A conventional vapor-recovery system is used to receive the overhead gas and condensate from the fractionator, consisting essentially of absorber, debutanizer, and depentanizer-splitter and sponge absorber. Charge of unstable gasoline and compressed wet gas is fed to the absorber from which off-gas is removed overhead. This passes through the sponge absorber and is then used for plant fuel.

Acknowledgment is hereby made to Pan-Am Southern Corp. and to W. E. McWhirter, process engineer at Destrehan, for assistance in the preparation of this article.

What Makes a Good Cat Cracker Feed

(Continued from page 164)

residuum and vacuum distills it to a 100, 200, 300 neutral distillate, a heavy intermediate distillate, and a residuum. The neutral distillates are the lightest of the vacuum still cuts and are the raw material which is further refined to produce 100, 200, and 300 neutral lube blending stocks. Average neutral distillate corresponds to about 200 neutral distillate. The first refining step of neutral distillate is a furfural extraction. Furfural extract is the extract portion of 100, 200, and 300 neutral distillate and represents about 30 to 40 volume per cent of the neutral distillate. Soft wax is extracted from the raffinate of the furfural-extraction step. The extraction is done on a methyl ethyl ketone wax-extraction unit. The wax referred to as soft wax is too soft to be of use commercially as such. Heavy intermediate or 500 neutral distillate is a vacuum-still product but it is Duo-Sol extracted instead of furfural extracted as are the lighter distillates.

This extract, of course, is heavy intermediate Duo-Sol extract and represents 40 per cent of the original heavy intermediate distillate. The vacuum tower residuum is also Duo-Sol extracted to make bright-stock extract and bright-stock raffinate. This bright-stock extract is visbroken and yields are presented for the gas oil from visbroken bright-stock extract and from gas oil produced by propane deasphalting of the tar from the bright-stock visbreaking operation.

Cycle oils . . . A third source of catalytic-cracking feed stock is from cycle oils produced on the catalytic crackers themselves. Heavy cycle oil corresponds roughly to virgin heavy gas oil in boiling range and light cycle oil to virgin light gas oil. Heavy cycle oil comes from two sources. It may be the result of a cracking reaction in a material which is heavier than heavy cycle stock such as deasphalted gas oil or it may be a result of cracking a material of its own weight such as virgin heavy gas oil. In the first case ("A" heavy cycle oil) it is probably largely a cracked product and in the second case ("B" heavy cycle oil) it is probably a cracked product mixed with some unreacted virgin oil.

Heavy cycle oil may also be the product of cracking heavy cycle oil from the first two sources mentioned ("C" heavy cycle oil). Light cycle oil may also be a product from a material of its own weight ("A" light cycle oil) or a heavier one ("B" light cycle oil). The feed stock

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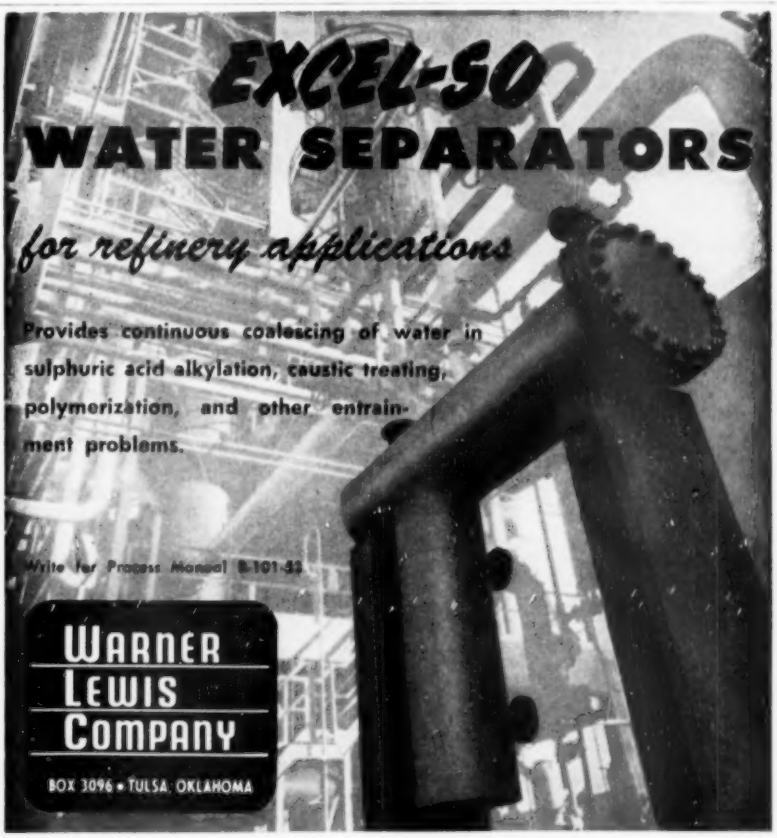
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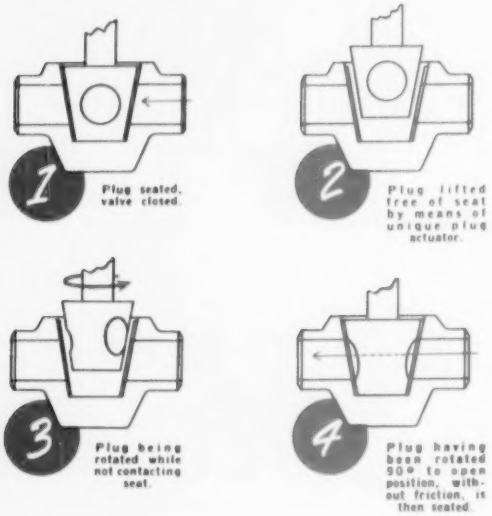
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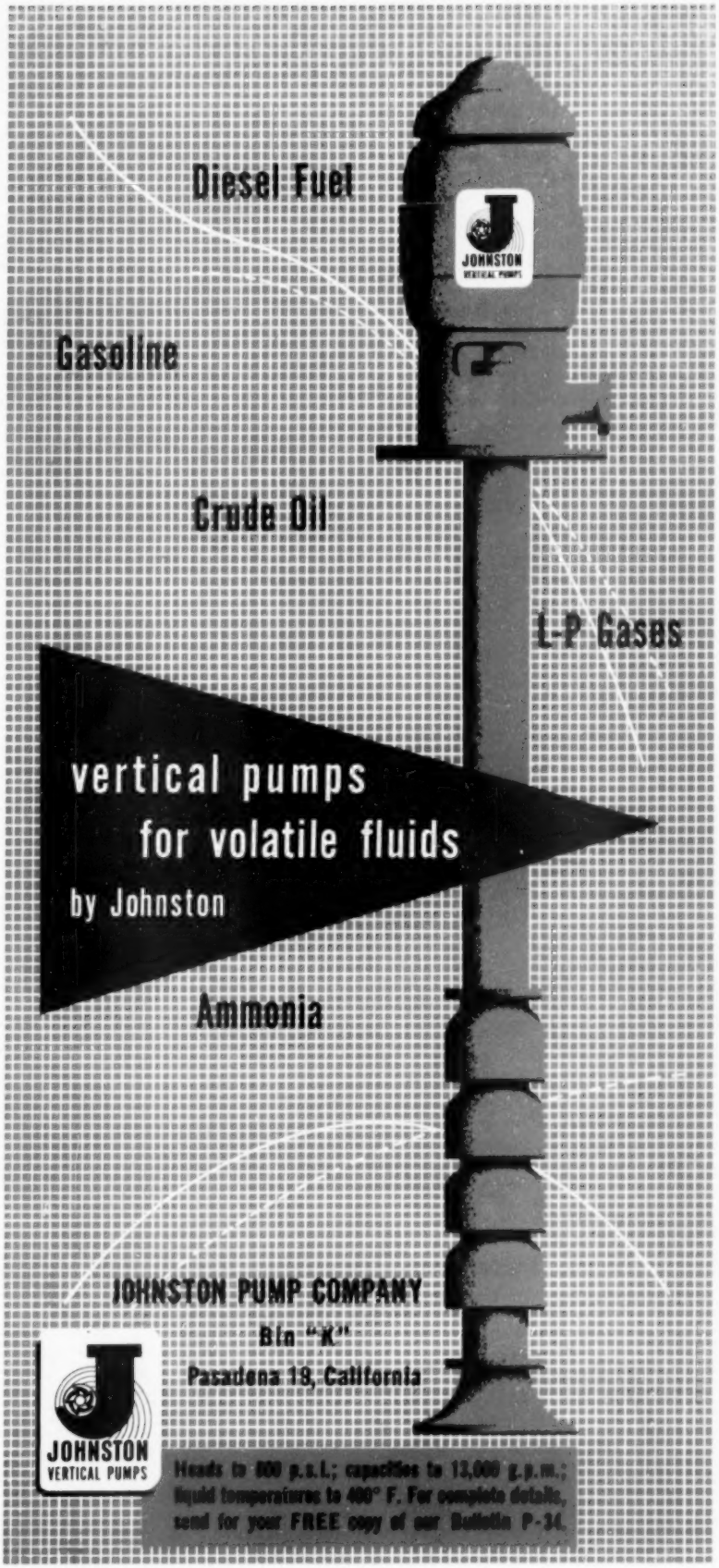
referred to as rerun bottoms is the oil which is produced from the further fractionation of catalytic fractionator overhead. Actually, it is a recycle light cycle oil but its boiling range is lower than that of light cycle oil.

Yields for the various feed stocks are presented in Table 2. Yields are taken at a reactor temperature of 900° F., 30 D+L catalyst activity (M. W. Kellogg method), and 0.5 weight per cent carbon on regenerated catalyst. The yields are presented at two different severities of operation. Obviously these severities and unit conditions cannot be optimum for all of the feed stocks involved. These yields would vary somewhat for every individual cracking unit depending on completeness of spent-catalyst stripping, reactor temperature, catalyst activity, etc. These are basic yields. Volume per cent conversion is the total feed above 400° F. A.S.T.M. minus product above 400° F. A.S.T.M. divided by the total feed above 400° F. A.S.T.M.

Virgin gas oils . . . Virgin heavy and light gas oils (Columns 1 and 2, Table 2) are probably the most commonly used feed stocks today. The yield structures of both at equal conversion levels are about the same, reasonably good yields of the important conversion products with a moderate coke yield. Virgin light gas oil is converted less for a given set of cracking conditions and produces much more light cycle oil than does virgin heavy gas oil due to the boiling ranges of the two feeds.

Deasphalted gas oil (Column 3, Table 2) is relatively easily cracked being both a virgin feed and having a high boiling range. It has an average Conradson carbon residue of 3.0 weight per cent. This carbon residue goes directly to coke giving deasphalted gas oil a higher coke yield, particularly at low conversion levels, than might otherwise be expected. This is the reason that the coke yield from deasphalted gas oil increases less rapidly than it does from other feed stocks. This effect may not be noted in Table 2.

Deasphalted gas oil from sour West Texas crude usually has a considerably higher weight per cent Conradson carbon than deasphalted gas oil from sweet crudes. Hence this deasphalted gas oil makes more coke than regular deasphalted gas oil. Experience has indicated that carbon residue carries the bulk of catalyst contaminants. West Texas deasphalted gas oil has more Conradson carbon and is a more contaminating feed stock than regular deasphalted gas oil. Another characteristic of deasphalted gas oil is that at a given conversion it has a high gasoline yield and a low total butanes-



butylenes yield. It also yields more heavy than light cycle oil.

Heavy cycle stocks . . . Except for coke yield the yields and conversions from first-pass heavy cycle stocks (Columns 4 and 5, Table 2) are practically identical. The yield structure here is similar to the yield structure from virgin heavy gas oil. The "A" heavy cycle stock yields slightly more coke than "B" heavy cycle stock. Heavy cycle stock yields more heavy cycle oil than does virgin heavy gas oil at a given conversion. Yields from "C" heavy cycle stock, a second-pass stock (Column 6, Table 2), have the same general structure as those from "A" and "B" heavy cycle stock but for a given conversion more coke is produced. This increase is quite marked indicating a rapid decline in heavy-cycle-stock quality with each catalytic-cracking pass. The "C" heavy cycle stock is also cracked less for a given severity and is further evidence of the decline in the quality of heavy cycle stock with each pass.

Light cycle stocks . . . The yields from light cycle stock (Columns 7 and 8, Table 2) bear about the same relation to the yields from virgin light gas oil that heavy-cycle-stock yields bear to virgin heavy-gas-oil yields. In general, light cycle oil is relatively hard to crack but does not make an excessive amount of coke. The product yield is good from an economic viewpoint. The "A" light cycle oil is easier to crack than "B" light cycle oil. This is because "B" light cycle oil is a cracked product. Rerun bottoms (Column 9, Table 2) a light second-pass light gas oil gives relatively good yields from an economic viewpoint but requires a high severity of operation to crack very much.

Distillates . . . Neutral distillates (Column 11, Table 2) cracks more easily and produces slightly less coke than does virgin heavy gas oil but otherwise it is similar to it in conversion-yields characteristics. Conversion yields would be cracking products other than gas oils. Neutral distillate produces more heavy than light cycle oil. Furfural extract (Column 10, Table 2) is quite similar to heavy cycle oils in its cracking characteristics. About the principal difference is that it cracks more easily and yields considerably less propylene.

Soft wax (Column 12, Table 2) is about the ideal catalytic cracking feed stock. It cracks very easily, makes very little coke, and gives high yields of total butanes-butylenes and gasoline, both very valuable products. It does yield much more heavy than light cycle oil which is about its only fault.

Heavy intermediate distillate (Column 13, Table 2) gives yields which are very similar to those from deasphalted gas oil. The principal difference is that heavy intermediate distillate is easier to crack. Heavy intermediate Duo-Sol extract (Column 14, Table 2) yields a high amount of coke for a given conversion. It tends to show the high ratio of gasoline to butanes-butylenes yield which is characteristic of deasphalted gas oil and to show more heavy than light cycle oil production also characteristic of deasphalted gas oil.

Gas oil from visbreaking bright stock extract (Column 15, Table 2) is somewhat similar to a light cycle stock. It is hard to crack, yields a considerable amount of coke, and has a yield split quite similar to that from a light cycle stock. Deasphalted gas oil from visbroken bright-stock extract and from visbroken asphalt (Columns 16 and 17, Tabie 2) are practically the same. Both are similar to yields from a cycle stock but yield a very large percentage of coke. Hence they are not particularly valuable feed stocks.

Authors are associated with Cities Service Refining Corp., Lake Charles, La. Oden is chief process engineer, and Perry is process engineer. Paper originally presented at regional meeting, W.P.R.A., Beaumont, Tex., February 12, 1954.

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by W. L. Nelson
Technical Editor

QUESTIONS ON TECHNOLOGY

Labor Component in Cost Index

"We note the use of a 60 per cent labor component in your Nelson Construction Cost Index along with unfinished raw materials rather than the more customary 35 or 45 per cent labor component used along with finished-material costs. What are the reasons for such a usage." J. J. V.

Although process or refinery engineers are more accustomed to thinking of finished or semifinished materials costs (e.g., vessels, tanks, towers or fabricated structural products rather than ore, scrap, tars, plate, pig iron, etc.) and a labor cost for assembling the semifinished materials, it is obvious that labor costs also constitute much of the cost of the semifinished materials. Accordingly, it was felt in developing the Nelson Refinery Construction Index that variations in labor costs could be more faithfully represented by 60 per cent used with raw or semifinished-materials costs than by 40 per cent used with finished-materials costs. In addition and from a practical standpoint, accurate costs of basic raw materials such as iron and steel, glass, concrete, building brick, etc., can be obtained with ease whereas finished material or product costs are not always available and they are subject to greater variations than are basic materials costs. Such a position cannot, however, be carried to the extreme by saying that materials represent nothing but the cost of the labor consumed in making useful materials out of the free elements which compose our earth.

The labor component of 60 per cent was selected by inspection of the actual costs of assembling and erecting finished materials in petroleum refinery installations, and adding to these costs the difference in cost between raw or basic materials and finished or semifinished materials. In selecting 60 per cent, attention was also given to the fact that improvements in labor-saving methods are expected to continue into the future and that labor costs will continue to constitute a smaller and smaller proportion of the total cost. Thus, 60 per cent was selected even though 65 per cent might have been more representative of conditions during 1925, and 55 per cent might be more representative of conditions in the future.

Nitrogen Content Of Crude Oils

"What is the relationship of a high nitrogen content in Pennsylvanian sands normally productive in surrounding areas, but nonproductive in the Rock Springs, Wyo., area? This sand also contains some carbon dioxide and sulfur water." W.G.H.

This department does not specialize in geological matters, but an opinion has gradually developed that nitrogen content is not very directly related to geological age.

High nitrogen content is associated with low-gravity or asphaltic types of crude oils. This is clearly evident in Fig. 1. Inasmuch as California oils are all of the Tertiary age, it might be concluded that Tertiary oils are high in nitrogen. However, a further examination as in Fig. 2, shows that Venezuelan Tertiary oils contain about the same amount of nitrogen as other ages of oils and that many Texas oils of Tertiary origin contain much less nitrogen than average. Cretaceous oils may contain less nitrogen than other oils (see Fig. 2) but it is not certain that discoveries of new Cretaceous fields may not be high in nitrogen. There seems to be nothing characteristic about Carboniferous (Pennsylvanian) oils.

The ratio of basic nitrogen to total nitrogen seems to be almost a constant (about 0.27) for all oils except those of very low total nitrogen content, where the ratio ranges upward to even 0.8 at a total nitrogen content of nearly zero.

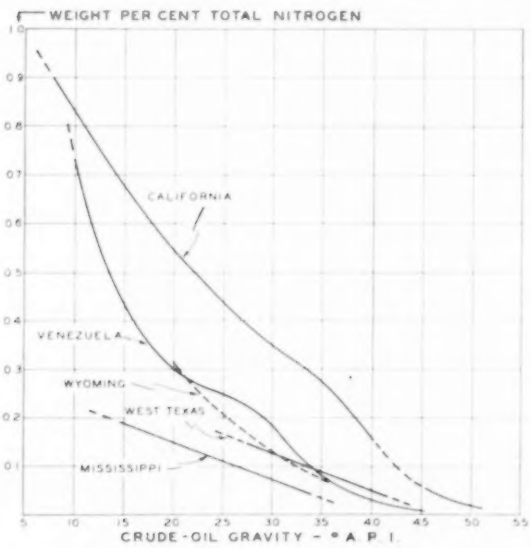

Fig. 1—Comparison of nitrogen content of crude oils.

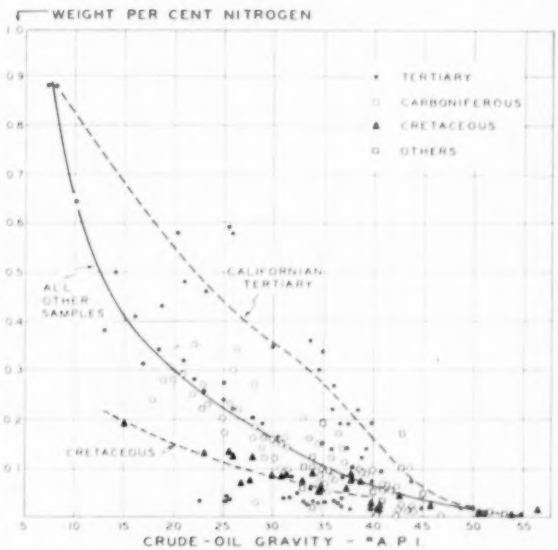

Fig. 2—Nitrogen content of crude oils of various geological ages.

What to Do About Lost Circulation—1

by J. M. Bugbee

THERE is no way to successfully plug a highly cavernous or open-fissured zone to permit conventional rotary drilling. Examples of this would be the drilling into a cavern like the Carlsbad in New Mexico or an abandoned coal mine, as has happened in Illinois.

The method of blind drilling, where water is pumped down the drill pipe to cool the bit and carry the cuttings into the loss zone and no returns are secured at the surface, has been developed for these conditions. An important variation is the use of a floating mud cap when drilling blind. Generally, each such loss zone is cased off after penetration.

The adoption of these procedures in Saudi Arabia *(see The Oil and Gas Journal, December 20, 1951, page 197)* was the means for the reduction in average drilling time from 120 days to 40 days. As much as 20,000 bbl. per day of water is pumped down the drill pipe to cool the bit and carry the cuttings into the loss zone.

It is noted that the floating mud-cap method requires careful balancing of formation-fluid pressures with drilling and hydrostatic pressures.

Recently, blind drilling in several wells in Denton field, New Mexico, has successfully penetrated an apparently unplugged zone occurring below 9,500 ft. In one case, the cuttings rather quickly bridged in the loss zone to give partial returns. After some additional drilling, a gel-cement plug was squeezed into the loss zone and full returns were then secured during the further drilling to some 12,000 ft.

No cuttings . . . One objection to blind drilling in prospect wells is the absence of formation samples. This can be partially alleviated by the securing of occasional conventional cores.

Author is with Shell Oil Co., Houston. From a paper presented at A.P.I. Division of Production meeting, Fort Worth.

A related drilling method is to drill under pressure, pumping water or oil down the drill pipe, and permitting the formation fluids to flow from the annulus.

Floating mud-cap drilling has been used in Sunniland, Florida, field. Seven or eight wells were so drilled and then the use of a low-pressure drilling head with the well flowing was adopted. This latter method has been used where artesian flows have been encountered in shallow beds. The balance between mud densities which cause loss or permit flow can be very close at shallow depths.

Where serious lost circulation occurs in formations located above the water table, air drilling has proved very successful for drilling the surface hole.

Waiting Periods

In many areas merely allowing a well to stand without pumping seems to permit the formations to adjust themselves to new pressure conditions and to allow full returns after the waiting period. One operator, in a Gulf Coast well, made the following tests of this time factor:

Waiting period, hours	0	1	2	4	8
Casing pressure at which formation took mud, psi.	350	275	150	150	525

The effect of waiting is probably most notable in the Gulf Coast but it is also used to advantage in North Texas and other areas.

Formations frequently strengthen, as regards mud losses, on exposure to mud and the drilling operation. For example, in a well in coastal Louisiana which was drilling with a 15-lb. per gal. mud below a protective string, a pressure test was made to see whether a 17-lb. mud could be circulated; the formation took mud at the imposed pressure.

Drilling was then continued with the 15-lb. mud for some 200 ft. at which time the mud was slowly weighted up to 17 lb. per gal. This was accomplished and drilling continued without loss.

The practice of "pressure conditioning," i.e., the imposition of pump pressures to determine whether higher weight muds can be circulated is not generally deemed helpful because it disregards this increase of strength with exposure.

Exposure plus waiting . . . In a recent well in a coastal Louisiana field, there were five losses while drilling with a 17.0-lb. per gal. (127.5-lb. per cu. ft.) mud below a protective string. The first three were cured by pulling into the shoe and letting the well stand 8 hours. The fourth loss did not clear up after a waiting period and a "soft plug," a batch of mud equal to twice the volume of the open hole and loaded with about 15 lb. per bbl. of fiber and flake material, was equalized on bottom.

Drill pipe was pulled into the casing, the well allowed to stand 8 hours, and complete circulation was then secured. The lost-circulation material was not screened out but was circulated and a fifth loss occurred, probably the result of excessive pressure caused by the circulation of this material. A waiting period cured this final loss.

The mechanism by which a waiting period or exposure to the drilling operation strengthens loss zones is obscure. Sometimes a balled-up bit and drill collar are pulled and the cause is, therefore, removed. Generally, however, it is believed that the liquid mud entering fissures becomes dehydrated or thickens with time and serves as a gasket to strengthen the zone. This latter explanation also serves as an explanation of the success of soft plugs when displaced into fissures.

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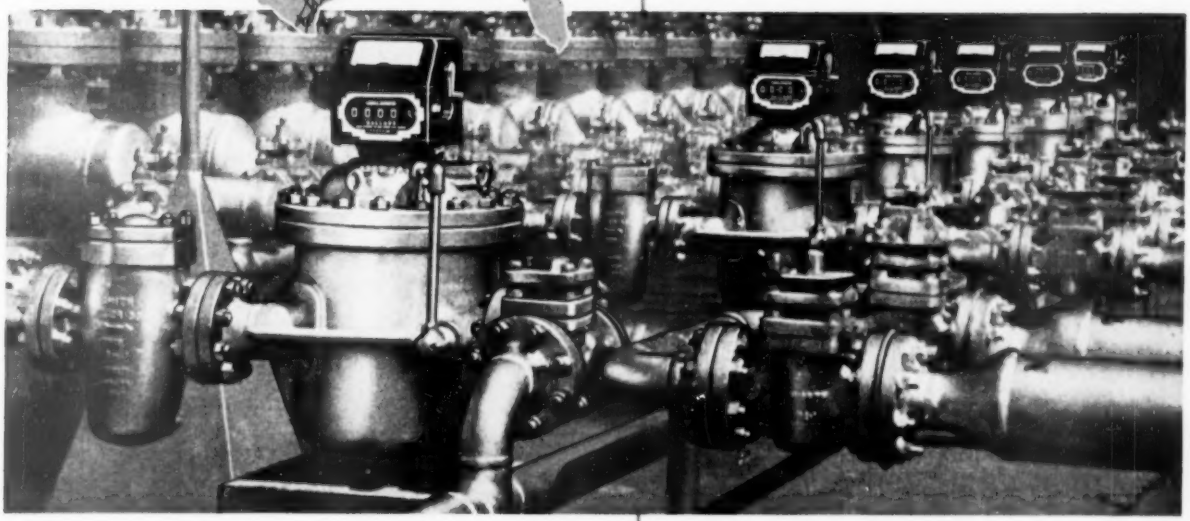

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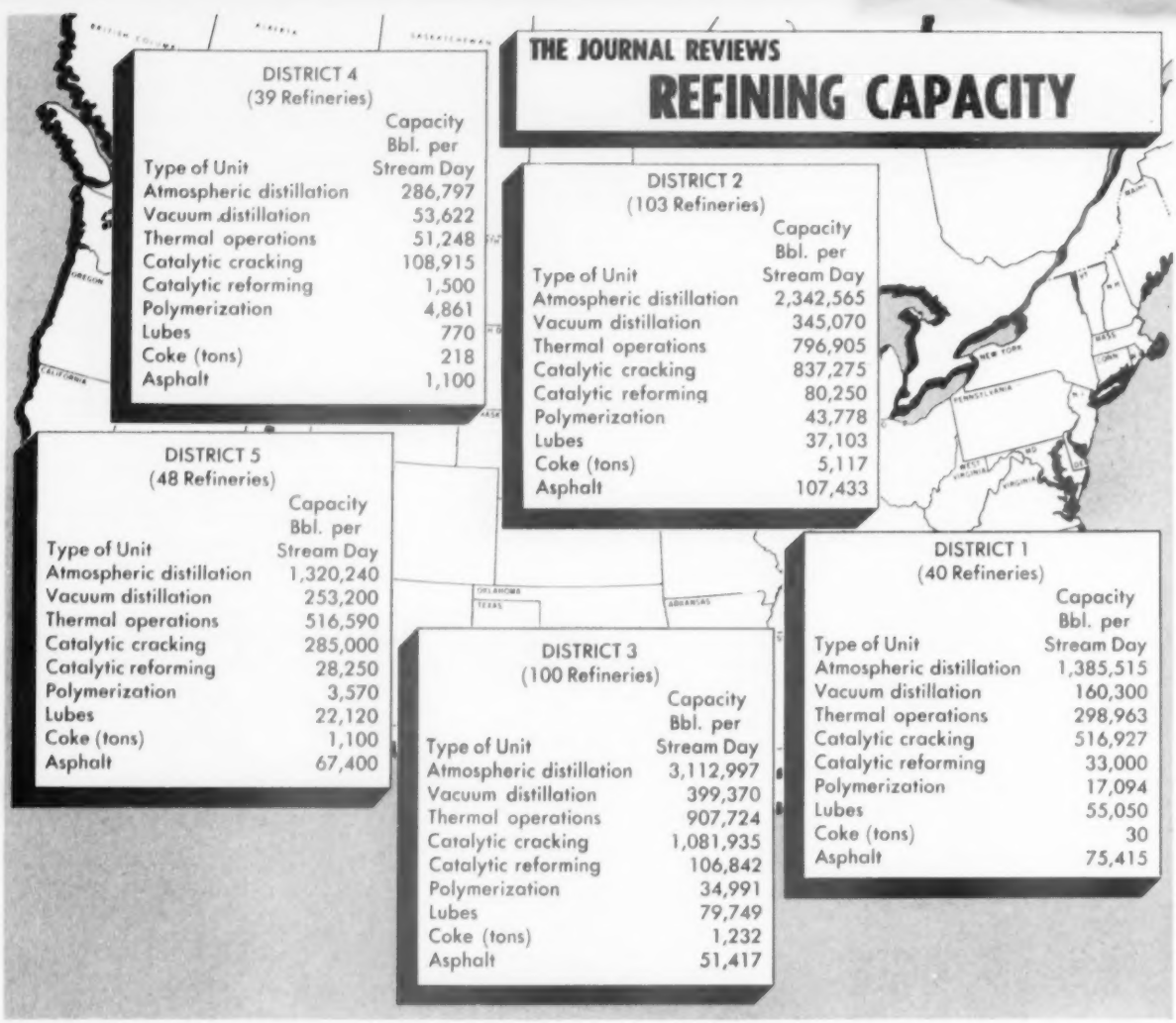


U. S. Refineries Near 8½ Million-Barrel Capacity

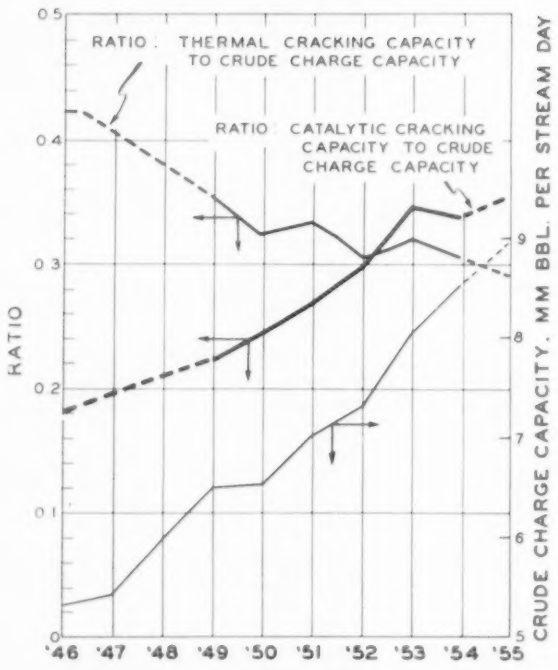
by John M. McGivern
District Editor

These are the highlights of the Journal's 1954 Refining Survey:

- A 4 per cent increase in crude capacity, over 1953.
- Addition of seven new refineries during the year.
- Increase of 18 per cent in vacuum distillation capacity.
- Coke production is up 18 per cent over 1953.
- Asphalt production increased significantly.

A 4 PER CENT increase in crude-oil capacity and the addition of seven refineries highlight the 1954 annual refinery survey conducted by The Oil and Gas Journal.

Capacity in the United States soared from 1953's record 8,094,283 to 8,437,314 bbl. per stream day, making the



REFINING-PROCESS TREND for postwar period.

Journal Survey of Refineries in the United States

THEIR DISTRIBUTION AND CAPACITY

State—	No. plants	Capacities, bbl. per stream day: Crude oil	Vacuum distillation	Thermal operations	Catalytic cracking	Catalytic reforming	Poly.	Lubes	Coke, tons	Asphalt
Alabama	4	8,500	8,000							12,000
Arkansas	6	71,200	5,790	30,500	33,000		750	3,450	400	6,315
California	45	1,315,800	243,200	516,950	285,000	28,250	3,570	22,120	1,100	58,550
Colorado	7	34,050	8,980	3,200	6,810		740			2,500
Delaware	1	3,500								1,800
Georgia	1	6,000								3,000
Illinois	13	520,880	37,400	173,075	193,410	15,300	7,748	4,923	1,692	14,525
Indiana	10	441,960	67,100	169,390	138,070	14,900	4,150	9,430	1,210	18,010
Kansas	14	272,025	63,000	87,290	119,470	4,000	7,050	3,500	335	11,950
Kentucky	5	86,000	12,000	26,000	28,300	500	2,500	300		14,000
Louisiana	16	653,500	130,600	125,482	260,428	7,992	8,297	18,600	330	12,300
Maryland	3	79,500	26,000	16,500	36,000			250		24,300
Massachusetts	1	50,000		15,000	24,000		1,000			6,750
Michigan	15	151,400	21,000	25,850	41,500	15,700	1,155		160	5,200
Minnesota	3	20,500			10,000		250			
Mississippi	2	11,100		1,600			90			2,300
Missouri	1	73,000	7,200	56,000	32,000		1,800		505	4,000
Montana	11	68,710	13,800	14,550	24,630		1,570			9,750
Nebraska	3	3,800		1,000						
New Jersey	7	528,850	73,300	92,226	212,670		7,800	16,970		22,200
New Mexico	8	24,990	2,500	7,850	6,000	1,600	405			1,000
New York	6	113,750	3,000	23,100	45,640		925	4,920		4,300
North Dakota	2	3,500				300				
Ohio	12	379,450	50,400	144,350	155,300	20,400	8,715	4,300	675	16,250
Oklahoma	21	371,650	81,970	111,520	116,225	8,150	9,005	11,200	540	12,000
Oregon	1		6,500							6,250
Pennsylvania	14	569,235	51,600	145,287	198,617	30,750	7,159	30,360	30	6,265
Rhode Island	3	13,880								2,200
South Carolina	1	8,000	6,400							4,600
Tennessee	2	7,500	3,000	1,200	3,000		1,000			
Texas	64	2,332,907	252,480	742,292	782,507	97,250	25,854	61,149	502	27,500
Utah	6	73,100	10,900	8,450	37,500		400	120		800
Washington	2	4,440	3,500							2,600
West Virginia	3	12,800		6,850		1,500	210	2,550		
Wisconsin	2	11,000	2,000	1,500		1,000				1,500
Wyoming	15	110,837	19,942	25,048	39,975	1,500	2,151	650	218	9,866
Total	330	8,437,314	1,211,562	2,571,790	2,830,052	249,092	104,294	194,792	7,697	324,581

second straight year that the 8,000,000-bbl. mark has been surpassed.

Among the new refineries to join the Journal's survey were two recently completed plants, Queen City Oil & Refining Co., of Dickinson, N. D., and Williston Basin Refining Co., of Williston, N. D. These marked the entry of North Dakota as a refining state. In addtion to these two, Standard of Indiana is building a 30,000-bbl. refinery at Mandan, N. D., to go on stream in 1954.

Vacuum distillation also showed an appreciable increase over the 1953 figures. The Journal survey showed a capacity of 1,027,674 bbl. in 1953, while 1954 figures showed an increase of 18 per cent to 1,211,562 bbl.

Asphalt production increased from 267,815 bbl. to 324,581. This increase was brought about largely by new plants being built rather than by additions.

Coke production was up 18 per cent from 6,504 tons to 7,697 tons and showed signs of increasing that much again during 1954. Lubes made a 4 per cent gain and catalytic and thermal polymerization gained 1.8 per cent.

Out of deference to a request by the Petroleum Administration for Defense, no figures on alkylation production or alkylation construction are reported.

Postwar refining changes . . . The 1954 survey points up the fact that the postwar trend in refining operations has been toward more intensive processing of each barrel of crude, while at the same time total capacity of operating United States refineries has increased about 65 per cent since 1946. As shown by the accompanying graph, ratio of catalytic cracking capacity to crude charge has increased from approximately 0.20 in the immediate postwar period to about 0.34 at the present time. The ratio is expected to climb to the vicinity of 0.36 by the end of the year.

Ratio of thermal operations (cracking, reforming, visbreaking, and coking) to total crude charge has dropped from about 0.40 just after World War II, to approximately 0.30. By end of 1954, ratio should drop to about 0.29.

Response to The Journal's questionnaires for the 1954 survey was especially gratifying. Reports were received from the operating companies on 329 of the 330 operating plants. The remaining one is known to be in operation, with an estimated crude capacity of 2,500 bbl. per day in simple topping service.

All capacities are reported consistently on a stream-day basis, to facilitate use of the tables, even though some companies reported calendar-day capacities.

. . . See following pages for detailed data on U. S. refineries

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Report on United States Operating Refineries

. . . Where they are, their capacities, and types of processes

EXPLANATION OF ABBREVIATIONS USED IN TABLES

THERMAL OPERATIONS:
C—Cracking
Ck—Coking
V—Visbreaking
R—Reforming

CATALYTIC CRACKING:
F—Fluid
Ho—Houdriflow
Hy—Houdry
T—Thermofor
Cy—Cycloversion
S—Suspensoid

CATALYTIC REFORMING:
Pf—Platforming
Hy—Hydroforming
Ho—Houdriforming
T—Thermofor
At—Atlantic
Cy—Cycloversion
Ul—Ultrafining

POLYMERIZATION:
C—Catalytic
T—Thermal

ASPHALT PRODUCTION:
S—Straightrun
O—Oxidized
M—Other

ALABAMA

	Charging, bbl. per stream day					Production			
	Crude oil	Vacuum dist.	Thermal operations	Cat. cr.	Cat. ref.	Poly.	Lubes	Coke, tons per day	Asphalt
American Bitumuls & Asphalt Co.:									
Mobile		6,000							S 4,800
									O 900
									M 2,300
Hunt Oil Co.:									
Tuscaloosa	4,500								
Vulcan Asphalt Refining Co.:									
Cordova	2,500	2,000							S 1,500
Warrior Asphalt Corp.:									
Holt	1,500								S 700
									O 300
									M 1,500
Total	8,500	8,000							12,000

ARKANSAS

Berry Asphalt Co.:									
Stephens	1,800	900							S 450
Waterloo	1,400	1,190					500		S 450
Henry H. Cross Co.:									
Smackover	6,000	1,200					700		S 700
Lion Oil Co.:									
El Dorado	24,000			F 10,000	C	400	1,000		S 3,100
				T 6,000					O 415
Macmillan Petroleum Corp.:									
Norphlet	4,000	2,500					1,250		S 1,200
Pan-Am Southern Corp.:									
El Dorado	34,000		C 13,500	F 17,000	C	350		400	
			R 7,000	(2 units)					
			Ck 10,000						
Total	71,200	5,790	30,500	33,000		750	3,450	400	6,315

CALIFORNIA

Bankline Oil Co.:									
Bakersfield	8,000		C 3,000						
Calstate Refining Co.:									
Long Beach			C 2,000						
Caminol Co.:									
Hanford	5,000	2,000	C 700		C	80			
			V 1,000						
			R 300						
Century Oil Co.:									
Long Beach	5,000								
Douglas Oil Co. of California:									
Bakersfield	8,000		C 4,600		At 2,500				
Paramount	5,000	3,400							S 2,500
									O 2,000
Santa Maria	3,300								S 2,100
Edgington Oil Refineries, Inc.:									
Long Beach	6,000	6,000					1,000		S 3,500
									O 3,500

CALIFORNIA (Continued)

	Charging, bbl. per stream day					Production			
	Crude oil	Vacuum dist.	Thermal operations	Cat. cr.	Cat. ref.	Poly.	Lubes	Coke, tons per day	Asphalt
Edgington Oxnard Refinery:									
Oxnard	2,700								S 2,200
Envoy Petroleum Co.:									
Long Beach	4,500								S 1,500
									O 200
Eureka Refining Corp.:									
Long Beach	4,000								
Fletcher Oil Co.:									
Wilmington	5,000		C 2,500			C 80			
General Petroleum Corp.:									
Torrance	125,000	38,000	V 26,000	T 52,000		C 600		1,100	
			Ck 26,000						
Golden Bear Oil Co.:									
Oildale		3,000					1,250		S 1,500
Hancock Oil Co.:									
Signal Hill	12,500		V 10,000						
Macmillan Petroleum Corp.:									
Long Beach	8,000						250		S 1,800
McAllen Refining Co.:									
Huntington Beach	5,000								S 500
Mohawk Petroleum Corp.:									
Bakersfield	11,000		C 3,800			C 60			
Newhall Refining Co.:									
Newhall	3,000								
Oxnard Oil & Refining Co.:									
Oxnard	2,500 est.								
Pabco Products, Inc.:									
Emeryville	3,000								O 2,700
Palomar Oil & Refining Corp.:									
Bakersfield		1,500					450		M 600
Richfield Oil Corp.:									
Watson	140,000	60,000	C 25,000	F 35,000		C 2,000			O 3,000
			V 27,000	T 25,000					
Rothschild Oil Co.:									
Santa Fe Springs	10,000		C 5,000		Pf 1,000	C 150			
Seaside Oil Co.:									
Ventura	4,500								S 300
Shell Oil Co.:									
Wilmington-Dominguez	79,000		C 36,000	F 25,000					
Martinez	55,000		C 30,000				3,100		S 4,200
Socal Oil & Refining Co.:									
Huntington Beach	2,500		C 1,600						
Standard Oil Co. of California:									
Bakersfield	22,000		9,900						S 1,200
El Segundo	132,000		C 64,900		Pf 11,000				S 9,000
			R 12,100						
Richmond	181,500	55,000	C 55,000	T 35,200	Hyf 13,750		11,000		S 12,000
			V 8,250						
Sunland Refining Corp.:									
Bakersfield	8,000		C 1,200						
Sunray Oil Corp.:									
Santa Maria	5,000		V 2,000						S 250
									O 100
Sunset Oil Co.:									
Torrance	9,000		C 2,500						
Superior Asphalt Co.:									
Oxnard	1,600								S 900
The Texas Co.:									
Wilmington	60,000		C 10,000	F 20,000					
Tide Water Associated Oil Co.:									
Avon	100,000	54,000	C, V 37,200	F 30,000			1,670		
Watson	15,000		V 9,000						
Tidewater Terminals Co., Inc.:									
Pinole	13,200			F 9,000					S 1,800
Triangle Oil & Refining Co.:									
Venice	2,500								
Union Oil Co. of California:									
Los Angeles	122,000		C 36,600	T 17,800					
				F 30,000					
Oleum	92,000	5,300	C 26,600				3,400	(*)	
			Ck 22,200						
Maltha	9,000								(*)
Western Asphalt & Refining Co.:									
Santa Maria	1,500								S 1,200
Wilshire Oil Co., Inc.:									
Norwalk	24,000	15,000	15,000	F 6,000		C 600			
Total	1,315,800	243,200	516,950	285,000	28,250	3,570	22,120	1,100	58,550

*Not reported.

The Petroleum Industry

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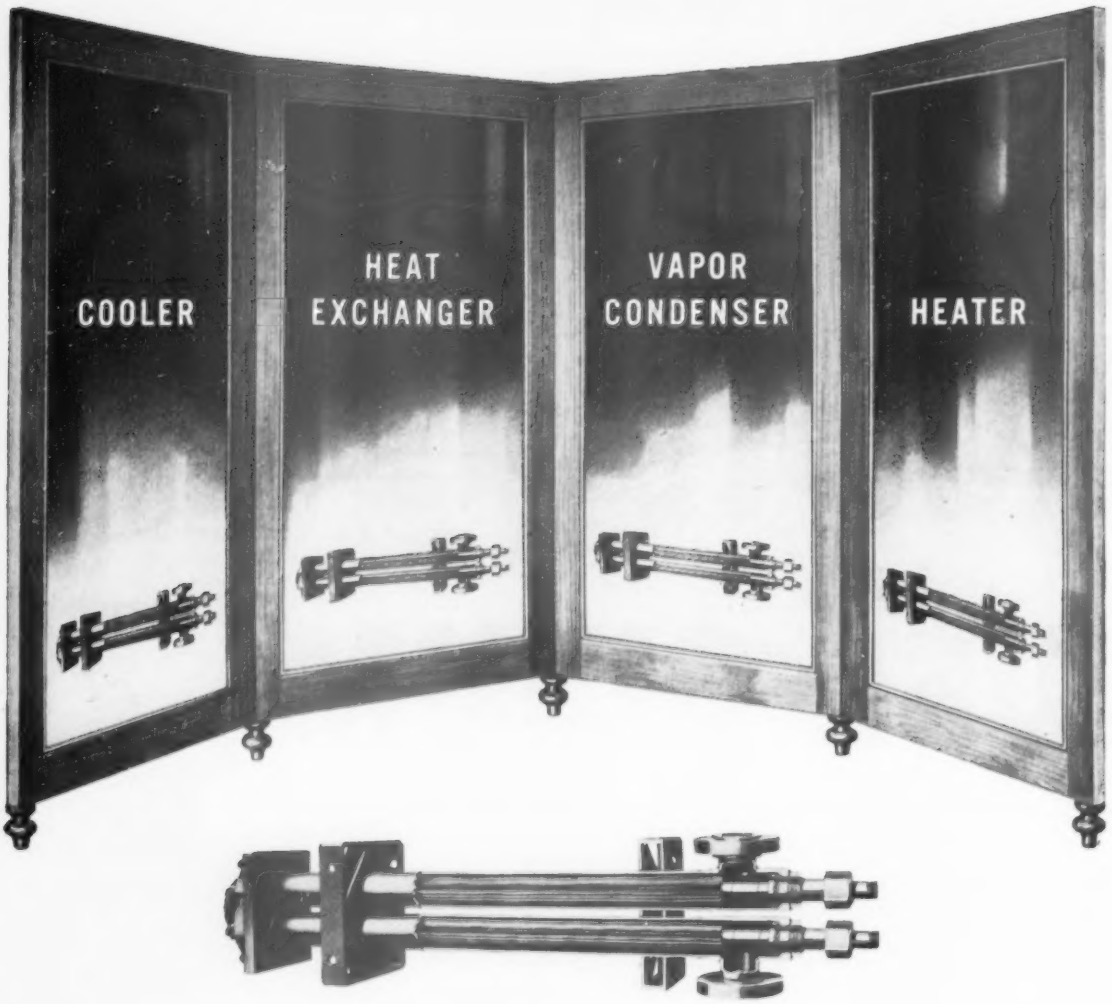

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G-R HEAT TRANSFER APPARATUS **Twin G-Fin Section**

GR-308

COLORADO

	Charging, bbl. per stream day: Crude oil	Vacuum dist.	Thermal operations	Cat. cr.	Cat. ref.	Production: Poly.	Lubes	Coke, tons per day	Asphalt
Bay Petroleum Corp.:									
Denver	8,000	4,000		F 3,500		T 300			
Continental Oil Co.:									
Denver	9,900	1,980		T 3,310		C 440			
Empire Petroleum Co.:									
Denver	8,000	3,000							S 2,500
Oriental Refining Co.:									
Alamosa	1,000		C 500						
Denver	3,500		C 1,500						
Skelly Oil Co.:									
Denver	1,650		C 800						
Wesco Refining Co.:									
Rangely	2,000		R 400						
Total	34,050	8,980	3,200	6,810		740			2,500

DELAWARE

The Texas Co.:									
Claymont	3,500								1,800
Total	3,500								1,800

GEORGIA

Mexican Petroleum Corp. of Georgia:									
Savannah	6,000								S 3,000
Total	6,000								3,000

ILLINOIS

Advance Refining Co., Inc.:									
Centralia	2,500			Cy 650	Cy 650				
Calumet Refining Co.:									
Burnham	1,200	1,200					750		S 225
Henry H. Cross Co.:									
Colmar	1,000								
Globe Oil & Refining Co.:									
Lemont	45,000	15,000	C 6,000	F 12,000		C 1,400			
			V 3,500						
			R 6,500						
Ohio Oil Co.:									
Robinson	40,000	(*)	C 9,000	F 18,500	Ho 8,000	C 1,500		250	
			Ck 6,000						
Pana Refining Co.:									
Pana	6,000		C 2,200		Pf 650	C 100			
Petco Corp.:									
Blue Island	20,000		R 4,000	Ho 7,500		C 475			S 1,000
Shell Oil Co.:									
Wood River	170,000		C 15,500	F 55,000		C 850	3,100	800	S 3,500
			R 20,000						
			Ck 15,000						
Sinclair Refining Co.:									
Hartford	28,000	15,000	C 6,000	F 11,000	Cy 6,000	C 800			S 1,500
									O 500
Socony-Vacuum Oil Co., Inc.:									
East St. Louis	42,180	(*)	C 3,300	T 17,760				266	
			R 2,775						
			Ck 9,900						
Standard Oil Co. (Ind.):									
Wood River	50,000	6,200	C 10,200	F 16,000		C 123	1,073	126	S 2,500
			V 3,400						O 2,500
			R 7,060						M 1,800
			Ck 3,740						
The Texas Co.:									
Lawrenceville	50,000		C 14,000	F 30,000		C 2,000			S 400
Lockport	65,000		C 13,000	F 25,000		C 500		250	S 600
			Ck 12,000						
Total	520,880	37,400	173,075	193,410	15,300	7,748	4,923	1,692	14,525

*Not reported. †Included in crude unit.

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INDIANA

	Charging, bbl. per stream day					Production			
	Crude oil	Vacuum dist.	Thermal operations	Cat. cr.	Cat. ref.	Poly.	Lubes	Coke, tons per day	Asphalt
Allby Asphalt & Refining Corp.:									
Hammond									O 2,500
									M 2,500
Berry Asphalt Co.:									
Gary	6,000								
Cities Service Oil Co.:									
East Chicago	40,000		R 2,700	F 16,000				280	
			Ck 8,900						
Indiana Farm Bureau Coop. Association, Inc.:									
Mount Vernon	9,500	3,600	C 3,000	F 3,750		C 300			
Jarvis Refining Co.:									
Troy									S 1,500
R. J. Oil & Refining Co., Inc.:									
Princeton	3,000				Pf 900				
Rock Island Refining Corp.:									
Rock Island	13,500			F 6,500		C 400			
Sinclair Refining Co.:									
East Chicago	110,000	44,000	C 10,000	F 34,000		C 2,450	2,750		S 4,000
			V 9,000						
			R 13,000						
Socony-Vacuum Oil Co., Inc.:									
East Chicago	39,960	(*)	10,490	T 17,820					
Standard Oil Co. (Ind.):									
Whiting	220,000	19,500	C 42,000	F 60,000	Hy 14,000	C 1,000	6,680	930	S 760
			V 14,000						O 6,500
			R 15,300						M 250
			Ck 41,000						
Total	441,960	67,100	169,390	138,070	14,900	4,150	9,430	1,210	18,010

*Not reported.

KANSAS

Anderson-Prichard Oil Corp. (Formerly Kanotex Ref. Co.):									
Arkansas City	15,000	5,500	C 3,500	F 5,500	Cy 4,000	C 500			S 800
Chanute Refining Co., The:									
Chanute	1,000		V 1,000						
Cooperative Refinery Assn.:									
Coffeyville	25,000	6,500	C 4,500	F 6,500		C 400	1,500		S 1,800
			R 1,000						
Phillipsburg	8,000			F 4,250		C 400			S 650
Derby Oil Co., The:									
Wichita	16,000	5,500	C 3,000	T 7,500		C 450			S 1,500
El Dorado Refining Co., The:									
El Dorado	12,000	4,500	C 1,200	F 5,400		C 1,500			S 1,000
			R 1,000						O 400
M.F.A. Oil Co.:									
Chanute	2,000		C 1,200						
National Cooperative Refinery Association:									
McPherson	26,000	5,000	C 3,000	F 11,000		C 1,000		250	
			R 2,500						
			Ck 9,000						
Phillips Petroleum Co.:									
Kansas City	55,000	15,000	V 4,500	F 30,000		C 1,100	2,000		S 1,500
			R 7,800						
Shallow Water Ref. Co., The:									
Garden City	4,000	2,000	C 1,300	Cy 1,500					S 1,000
									M 300
Skelly Oil Co.:									
El Dorado	45,000	12,000	C 12,000	F 16,000		C 1,200			S 2,500
			R 5,000						
Socony-Vacuum Oil Co., Inc.:									
Augusta	30,525	(*)	C 8,290	T 17,820					(*)
Standard Oil Co. (Ind.):									
Neodesha	20,500		C 5,400	F 9,000				85	M 500
			R 2,600						
			Ck 5,100						
Vickers Petroleum Co., Inc., The:									
Potwin	12,000	7,000	C 3,400	T 5,000		C 500			
			R 1,000						
Total	272,025	63,000	87,290	119,470	4,000	7,050	3,500	335	11,950

*Not reported.

KENTUCKY

	Charging, bbl. per stream day					Production			
	Crude oil	Vacuum dist.	Thermal operations	Cat. cr.	Cat. ref.	Poly.	Lubes	Coke, tons per day	Asphalt
Ashland Oil & Refining Co.:									
Catlettsburg	50,000		C 6,000 R 2,500	F 25,000		C 1,500	300		S 4,500 O 4,500 M 1,500
Louisville	9,500		C 4,500						
Louisville Refining Co.:									
Louisville	7,000		C 2,500	F 3,300		T 500			
Sohio Petroleum Co.:									
Covington	18,000	12,000	C 7,000 R 3,500			T 500			O 3,500
Somerset Refinery Co., The:									
Somerset	1,500				Cy 500				
Total	86,000	12,000	26,000	28,300	500	2,500	300		14,000

LOUISIANA

Bay Petroleum Corp., The:									
Chalmette	18,000	9,000		F 7,500		T 800			
Bayou State Oil Corp.:									
Houston	1,000	1,600					500		
Breaux Bridge Oil & Refining Co., Inc.:									
Breaux Bridge	1,600								
Calumet Refining Co.:									
Princeton	900						600		O 250
Canal Refining Co.:									
Church Point	1,500								
Cit-Con Corp.:									
Lake Charles							9,000		
Cities Service Refining Corp.:									
Lake Charles	155,000		C 10,000	F 77,000					
Continental Oil Co.:									
Westlake	49,950		C 5,106 R 1,776	T 16,928	Pf 5,992	T 666 C 666			
Cotton Valley Solvents, Inc.:									
Cotton Valley	4,000								
Esso Standard Oil Co.:									
Baton Rouge	320,000	116,000	C 36,500 V 20,000 R 9,000	F 141,000		C 5,000	8,500		S 6,000 O 200
Evangeline Refining Co.:									
Jennings	1,250		C 300						
Ingram Oil & Refining Co.:									
Meraux	8,000	4,000		F 3,000		C 250			
Pan-Am Southern Corp.:									
Destrehan	28,800		Ck 10,000	F 15,000	Hy 2,000 (Fluid)			300	S 2,750 O 500 M 300
Petco Corp.:									
Marrero	6,500		C 3,000 R 1,000			C 125			
Shell Oil Co.:									
Norco	50,000		C 22,500 R 2,000			C 600			S 1,800 O 200 M 300
Stanolind Oil & Gas Co.:									
Superior	7,000		C 3,200 R 1,100			C 190			
Total	653,500	130,600	125,482	260,428	7,992	8,297	18,600	330	12,300

MARYLAND

American Bitumuls & Asphalt Co.:									
Baltimore	7,500		V 6,000						S 6,000 M 4,300
Esso Standard Oil Co.:									
Baltimore	62,000	26,000	C 4,000 V 6,500	F 36,000			250		S 7,000 O 2,000
Pan American Refining Corp.:									
Baltimore	10,000								S 5,000
Total	79,500	26,000	16,500	36,000			250		24,300

MASSACHUSETTS

	Charging, bbl. per stream day					Production			
	Crude oil	Vacuum dist.	Thermal operations	Cat. cr.	Cat. ref.	Poly.	Lubes	Coke, tons per day	Asphalt
Esso Standard Oil Co.:									
Everett	50,000		V 10,000	F 24,000	C	1,000			S 6,000
			R 5,000						O 750
Total	50,000		15,000	24,000		1,000			6,750

MICHIGAN

Aurora Gasoline Co.:									
Detroit	35,000	16,800	C 5,000	F 12,000	Pf 7,000	C 800			S 3,000
Elsie	7,500				Pf 1,500				
Muskegon	10,000		C 3,500		Pf 2,400	C 100			
Bay Refining Corp.:									
Bay City	10,500								
Crystal Refining Co. of Carson City, Inc.:									
Carson City	6,200								
Lakeside Refining Co.:									
Kalamazoo	3,500		V 1,200	Cy 1,000					
Leonard Refineries, Inc.:									
Alma	8,500	5,000	R 2,000	T 7,500		C 100			S 1,500
									O 500
									M 200
Marvel Refining Co.:									
Grand Rapids	2,000								
Mid-West Refineries, Inc.:									
Alma	10,000		C 3,200		Pf 2,000	C 80			
Naph-Sol Refining Co.:									
Muskegon	5,000		C 2,500			T 75			
Osceola Refining Co., Inc.:									
Reed City	2,500								
Petroleum Specialties, Inc.:									
Flat Rock	6,500				Pf 1,000				
Pure Oil Co.:									
Midland	4,700								
Roosevelt Oil & Refining Corp.:									
Mount Pleasant	7,500			Cy 3,000	Pf 1,800				
Socony-Vacuum Oil Co., Inc.:									
Trenton	32,000		Ck 4,500	T 18,000				160	
			C 3,950						
Total	151,400	21,000	25,850	41,500	15,700	1,155		160	5,200

MINNESOTA

Northwestern Refining Co.:									
New Brighton	3,000								
St. Paul Park	6,000			F 5,000					
International Refineries, Inc.:									
Wrenshall	11,500			F 5,000		C 250			
Total	20,500			10,000		250			

MISSISSIPPI

Paluxy Asphalt Co.:									
Sandersville	5,600		C 1,600			T 90			S 200
									O 100
Southland Co.:									
Yazoo City	5,500								S 2,000
Total	11,100		1,600			90			2,300

MISSOURI

Standard Oil Co. (Ind.):									
Sugar Creek	73,000	7,200	C 19,600	F 32,000		C 1,800		505	S 2,000
			R 6,000						O 1,000
			Ck 30,400						M 1,000
Total	73,000	7,200	56,000	32,000		1,800		505	4,000

MONTANA

Big West Oil Co. of Montana:									
Kevin	2,200		C 1,000						
			R 250						
Carter Oil Co.:									
Billings	25,000	5,500		F 15,000		C 600			S 5,000

MONTANA (Continued)

	Charging, bbl. per stream day					Production			
	Crude oil	Vacuum dist.	Thermal operations	Cat. cr.	Cat. ref.	Poly.	Lubes	Coke, tons per day	Asphalt
Continental Oil Co.:									
Billings	8,810			F 3,630		C 440			
Farmers Union Central Exchange, Inc.:									
Laurel	15,000	7,500	C 5,000	F 6,000		C 500			S 4,000
Eugene Hunt:									
Winnett	300								
Modern Oil Co., Inc.:									
Shelby	1,000								
Phillips Petroleum Co.:									
Great Falls	2,800	800	C 1,200			C 30			M 250
Jet Fuel Refinery Co.:									
Mosby	600								
The Texas Co.:									
Sunburst	8,000		C 5,000						
Union Oil Co. of California:									
Cut Bank	4,000		C 2,100			(*)			
Unity Petroleum Corp.:									
Kalispell	1,000								S 500
Total	68,710	13,800	14,550	24,630		1,570			9,750

*Not reported.

NEBRASKA

Cooperative Refinery Assn.:									
Scottsbluff	2,200		C 1,000						
Searle Petroleum Co.:									
Salem	1,000								
Sioux Oil Co.:									
Chadron	600								
Total	3,800		1,000						

NEW JERSEY

California Oil Co.:									
Barber	64,000		V 5,000	Ho 25,000		C 300			S 5,500
Cities Service Oil Co. (Pa.):									
Linden	15,000								S 2,500
									O 1,500
									M 2,500
Esso Standard Oil Co.:									
Bayonne	28,500	12,800					6,000		S 8,200
									O 2,000
Linden	168,400	50,000	C 8,000	F 98,000		C 4,000			
			V 28,800						
			R 16,800						
Socony-Vacuum Oil Co., Inc.:									
Paulsboro	105,450	(*)	V, R 18,126	T 29,970			7,770		
The Texas Co.:									
Westville	60,000		R 9,000	F 30,000		C 2,500			
Tide Water Associated Oil Co.:									
Bayonne	87,500	10,500	C 3,300	T 12,200		C 1,000	3,200		
			R 3,200	Hy 17,500					
Total	528,850	73,300	92,226	212,670		7,800	16,970		22,200

*Not reported.

NEW MEXICO

Continental Oil Co.:									
Artesia	3,960		1,650						
Farmington	880								
Famariss Oil & Refining Co.:									
Monument	1,200								
Malco Products, Inc.:									
Bloomfield	750								
Malco Refineries, Inc.:									
Prewitt	2,500		C 1,000		At 1,000				
Roswell	2,500		C 1,000			C 65			
McNutt Oil & Refining Co., Inc.:									
Brickland	3,200		C 1,200		Pf 600	C 40			
New Mexico Asphalt & Ref. Co.:									
Artesia	10,000	2,500	C 3,000	T 6,000		C 300			S 1,000
Total	24,990	2,500	7,850	6,000	1,600	405			1,000

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New York Office: 17, BATTERY PLACE, NEW YORK 4, N.Y., U.S.A.
Telephone: WHITEHALL 3-8996 Cable: COFFDALE

NEW YORK

	Charging, bbl. per stream day: Crude oil	Vacuum dist.	Thermal operations	Cat. cr.	Cat. ref.	Production: Poly.	Lubes	Coke, tons per day	Asphalt
Frontier Oil & Refining Corp. (a division of Ashland):									
Tonawanda	25,000		R 3,000	F 10,000		C 825			S 2,000 O 2,000
Gulf Oil Corp.:									
Staten Island	18,700								
Sinclair Refining Co.:									
Wellsville	9,000	3,000	C 3,000 R 5,000			C 100	2,500		S 300
Socony-Vacuum Oil Corp., Inc.:									
Brooklyn	27,500		C 3,850	T 17,820					
Buffalo	26,400		R 5,500	T 17,820			1,100		
Olean	7,150		R 2,750				1,320		
Total	113,750	3,000	23,100	45,640		925	4,920		4,300

NORTH DAKOTA

Queen City Oil & Refining Co.:									
Dickenson	2,000								
Williston Basin Refining Corp.:									
Williston	1,500				At 300				
Total	3,500				300				

OHIO

American Bitumuls & Asphalt Co.:									
Cincinnati		8,000							S 6,000
Ashland Oil & Refining Co.:									
Canton	25,000	5,000	V 10,000	F 12,000		C 550			
Findlay	15,000	8,000	C 4,500 R 1,500			C 175	600		S 1,500 O 1,500 M 250
Dewese Oil Refinery:									
Weston	1,750	400					400		
Gulf Refining Co.:									
Cleves	33,000		C 13,530	F 13,200		C 1,650			
Toledo	44,000		C 13,420	F 13,200					
Pure Oil Co.:									
Newark	15,500		C, V, R 9,000	F 4,500		C 200			
Toledo	29,400		C, V, R 19,700 Ck 5,000	F 11,600	Hf 5,000 (f.b.)	C 1,270		175	
Standard Oil Co. (Ohio):									
Cleveland	55,000	18,000	C 12,000 R 10,000	T 20,000		C 600	1,600		O 7,000
Lima	50,000	11,000	C 5,000	F 28,000		T 800	1,700	320	
Toledo	25,000		C 8,000 R 7,000 Ck 7,000			C 500		180	
Sun Oil Co.:									
Toledo	85,800		R 18,700	Ho 17,600 Hy 35,200	Pf 15,400	C 2,970			
Total	379,450	50,400	144,350	155,300	20,400	8,715	4,300	675	16,250

OKLAHOMA

Allied Materials Corp.:									
Stroud	2,500	1,500							S 1,000 O 1,000
Anderson-Prichard Oil Corp.:									
Cyril	11,000	5,000	C 5,000			C 275			S 1,200 O 500
Bell Oil & Gas Co.:									
Grandfield	7,000		C 4,000		Pf 1,800	C 150			
Ben Franklin Refining Co.:									
Ardmore	12,000	7,000	C 4,500	F 6,000		T 600			M 1,100
Champlin Refining Co.:									
Enid	20,000	7,000	C 7,000 R 3,500			C 450	1,500		
Cities Service Oil Co.:									
Ponca City	22,000		C 800 R 1,950 Ck 1,950	F 10,000				100	
Continental Oil Co.:									
Ponca City	57,750	11,220	C 9,900 R 2,200 Ck 7,920	T 18,425	Hy 3,850	C 770	2,200	440	
Deep Rock Oil Corp.:									
Cushing	19,000	3,000	V 6,400	F 7,000		C 500	1,000		S 600

OKLAHOMA (Continued)

	Charging, bbl. per stream day						Production			
	Crude oil	Vacuum dist.	Thermal operations	Cat. cr.	Cat. ref.		Poly.	Lubes	Coke, tons per day	Asphalt
Johnson Oil Refining Co.:										
Cleveland	6,300		C 2,700	F 1,800						
Kerr-McGee Oil Industries, Inc.:										
Wynnewood	15,000	7,000		F 6,000		C	450			S 4,000
Mercury Oil Refining Co.:										
Oklahoma City	5,000		C 1,400							
Mid-Continent Petroleum Corp.:										
Tulsa	62,000	16,000	C 5,000	F 22,000		C	2,200	6,500		O 400
			V 6,000							
			R 3,500							
Midland Cooperatives, Inc.:										
Cushing	12,000		V 6,000	F 4,500		C	400			
Monarch Refineries, Inc.:										
Oklahoma City	1,000									O, S 1,000
Peppers Refining Co.:										
Oklahoma City	2,500	1,250	C 1,200		1,000	C	100			
Phillips Petroleum Co.:										
Okmulgee	14,500	3,000	V 2,800	T 8,000		C	600			M 200
Sunray Oil Corp.:										
Allen	13,000		C 9,000			C	250			
Duncan	33,600	13,000	V 2,500	F 13,000		C	350			S 1,000
The Texas Co.:										
Tulsa	35,000		C 9,000	F 15,000		C	1,500			
			R 5,000							
Tide Water Associated Oil Co.:										
Drumright	15,000	7,000		Ho 4,500		C	350			
Wilcox Oil Co.:										
Bristow	5,500		C 2,300		Pf 1,500	C	60			
Total	371,650	81,970	111,520	116,225	8,150		9,005	11,200	540	12,000

OREGON

American Bitumuls & Asphalt Co.:										
Portland		6,500								S 4,200
										O 900
										M 1,150
Total										6,250

PENNSYLVANIA

Atlantic Refining Co.:										
Philadelphia	136,085		C 14,985	F 33,300	At 11,110	C	2,109	5,550		S 2,220
			R 16,650							O 770
										M 1,665
Freedom-Valvoline Oil Co. (a division of Ashland Oil & Refining Co.):										
Freedom	5,000	2,300	C 500			T	30	1,000		
			R 500							
Gulf Oil Corp.:										
Neville Island	14,430		C 6,660							
Philadelphia	118,770		34,632	F 27,750				1,110		
Kendall Refining Co.:										
Bradford	5,000	300	C 1,500		Pf 1,500	C	100	1,200	30	
Pennsylvania Refining Co.:										
Karns City	1,500							300		
Pennzoil Co.:										
Rouseville	6,000	4,000	C 1,250	F 2,812		T	750	2,500		
			R 4,550							
Quaker State Oil Refining Corp.:										
Emlenton	3,000		C 1,350					1,700		
Farmers Valley	4,500		C 1,350					2,300		
Sinclair Refining Co.:										
Marcus Hook	100,000	45,000	C 5,000	F 36,000		C	1,850			
			V 18,000							
			R 9,000							
Sonneborn, L., & Sons:										
Franklin	2,000									S 500
Sun Oil Co.:										
Marcus Hook	160,950		R 26,640	T 22,200	Ho 15,540	C	2,220	13,100		O 1,110
				Hy 75,935						
United Refining Co.:										
Warren	9,500		V 2,000		At 2,600	C	100	1,600		
Wolf's Head Refining Co., Inc.:										
Reno	2,500		C 360	F 620						
			R 360							
Total	569,235	51,600	145,287	198,617	30,750		7,159	30,360	30	6,265

why you save money when pipe lines are protected with Dearborn NO-OX-ID coating combinations

Before you specify the coating for your next pipe line, check the many reasons "Why" it will pay you to select Dearborn NO-OX-ID Pipe Coatings and NO-OX-IDized wrappers. A Dearborn pipe line engineer is available for consultation.

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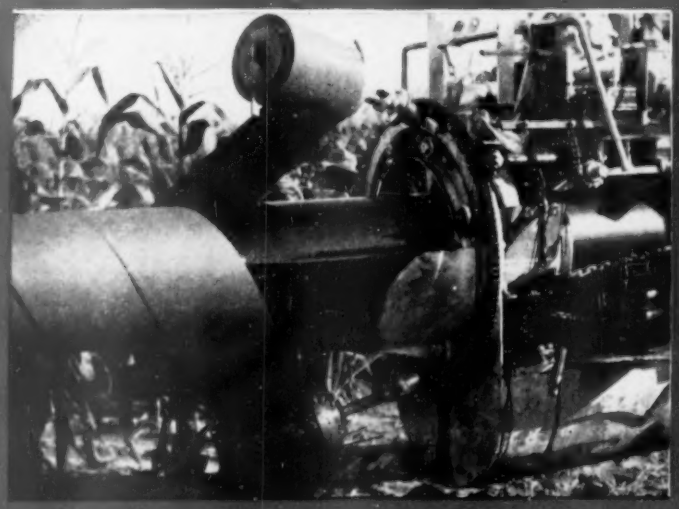
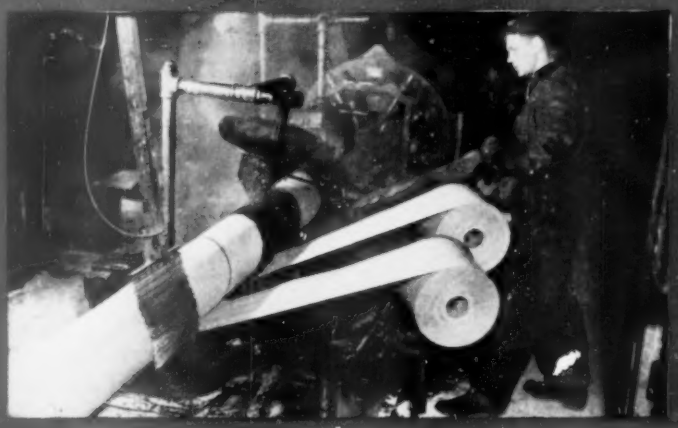


by Traveliner

On long lines, traveling machine application of NO-OX-ID and NO-OX-IDized Wrappers produces greater footage with smaller coating crews. NO-OX-IDs do not produce noxious or harmful fumes.

by Hand

Over rough terrain—on short lines—on maintenance jobs, Dearborn NO-OX-ID and NO-OX-IDized Wrappers are easily applied either cold or hot. A NO-OX-ID coating of only 1/32" is adequate for long term protection.



at the Mill

Independent applicators and many utilities rely on NO-OX-ID combinations applied by stationary coating machines for *complete* pipe line protection.

know your Dearborn Engineer

Dearborn has specialized in the control of corrosion and the conditioning of water since 1887. This broad experience—plus Dearborn's extensive research and laboratory facilities—are at your service...at no obligation. You'll find it will pay to know your Dearborn engineer.

FOR YOUR FILES...

This informative Dearborn book "Protecting Underground Pipe from Corrosion with NO-OX-ID and NO-OX-IDized Wrappers." Illustrates and describes all methods

YOUR COPY IS READY... UPON REQUEST

RHODE ISLAND

	Charging, bbl. per stream day					Production			
	Crude oil	Vacuum dist.	Thermal operations	Cat. cr.	Cat. ref.	Poly.	Lubes	Coke, tons per day	Asphalt
American Bitumuls & Asphalt Co.:									
East Providence	1,500	.....	.....						S 750 M 1,150
Socony-Vacuum Oil Co., Inc.:									
East Providence	8,800								(*)
The Texas Co.:									
Providence	3,500								S 300
Total	13,880								2,200

*Not reported.

SOUTH CAROLINA

Esso Standard Oil Co.:									
Charleston	8,000	6,400							S 4,000 O 600
Total	8,000	6,400							4,600

TENNESSEE

Delta Refining Co.:									
Memphis	6,500	3,000	C 1,200	T 3,000		C 1,000			
Southern Oil Service:									
Nashville	1,000								
Total	7,500	3,000	1,200	3,000		1,000			

TEXAS

American Liberty Oil Co.:									
Mount Pleasant	14,000	8,400	C 4,200 V 1,800	T 5,100		C 400			S 4,750 O 750 M 100
Atlantic Refining Co.:									
Port Arthur	67,710			F 28,860		C 111			
Bryson Pipe Line & Ref. Co., Inc.:									
Bryson	2,000						500		
Col-Tex Refining Co.:									
Colorado City	12,000	6,000	C 4,000		Pf 1,500	80			S 1,500 O 500
Continental Oil Co.:									
Wichita Falls	8,547		C 3,522 R 1,332			T 555 C 222			
Corpus Christi Refining Co.:									
Corpus Christi	8,000	2,000							
(Formerly Inland Refining)									
Palestine	2,000		C 1,000 R 750			T 100			
Cosden Petroleum Corp.:									
Big Spring	28,000	9,500	C 8,000	F 9,400	Pf 4,000	C 900			S 3,000 O 300 M 100
Crown Central Petroleum Corp.:									
Houston	30,000		C 8,000 R 1,200	T 17,500			1,000		
Dallawax Co.:									
Kilgore	500								
Danaho Refining Co.:									
Pettus	13,320		C 1,110	T 3,885		C 344			
Eastern States Petroleum Co., Inc.:									
Houston	50,000	20,000	C 4,000 V 14,000	F 16,000	Pf 7,000	C 1,000			
Eddy Refining Co.:									
Houston	2,250								
Flint Chemical Co.:									
San Antonio	300						250		
G. & B. Oil Co.									
(Formerly Ute Oil & Gas Co.):									
Graham	700								
Gladewater Refining Co.:									
Gladewater	2,500		C 1,500		Cy 600	C 100			
Gulf Oil Corp.:									
Fort Worth	9,435		C 4,440						
Port Arthur	271,950	27,750	C 93,462	F 59,940 T 27,750 Hy 9,990			13,320		
Sweetwater	8,325		C 4,440						

TEXAS (Continued)

	Charging, bbl. per stream day						Production			
	Crude oil	Vacuum dist.	Thermal operations	Cat. cr.	Cat. ref.		Poly.	Lubes	Coke, tons per day	Asphalt
Humble Oil & Refining Co.:										
Baytown	277,000		C 43,200 R 5,000	F 103,000	Hy 27,000	T	3,700	12,700		O, S 2,500
R. Lacy, Inc.:										
Big Sandy	4,000		C 1,000		Cy 1,000	C	50			S 1,000
Magnolia Petroleum Co.:										
Beaumont	199,800	25,530	C 5,550 V 57,720 R 12,210	T 78,477 Hy 12,765		T	2,220	7,104		
Fort Worth	13,320		C 8,325 R 1,998 Ck 5,883			C	1,887		127	
Matagorda Corp.:										
Bay City	1,850									
McBride Refining Co., Inc.:										
La Blanca	2,000				At. 1,000					
McMurrey Refining Co.:										
Tyler	25,000		C 3,500 Ck 10,000	F 7,500	Pf 5,500	C	800		75	
Monarch Refining Co.:										
San Antonio	2,500									
Onyx Refining Co.:										
Hawley	6,500		C 3,000 V 1,000 R 900		Pf 650					
Pan American Refining Corp.:										
Texas City	160,000		C 75,000 R 10,500	F 68,000	Hy 7,500 (f.b.)	C	4,800			S 5,500
Panhandle Oil Corp.:										
Wichita Falls	8,000		C 1,750	F 1,500		C	170			
Peerless Tank Cleaning Co.:										
Kilgore	1,000									
Petroleum Products Refining & Producing Co.:										
Lueders	1,500		C 1,000							
Petrolite Corp., Ltd.:										
Kilgore	700									
Phillips Petroleum Co.:										
Phillips	80,000	17,000	C 7,200 V 7,200 R 27,000	F 35,000 Cy 11,000		C	250			
Sweeny	85,000	17,000	C 5,000	F 26,000						
Phoenix Refining Co.:										
San Antonio	3,500									
Pontiac Refining Corp.:										
Corpus Christi	18,000	4,800	V 4,000 R 3,000	F 3,640		C	600			
Port Fuel Co., Inc.:										
Brownsville	7,500									
Premier Oil Refining Co.:										
Arp	5,000		C 2,500			C	50			
Baird	2,500		C 1,200							
Fort Worth	7,500	1,700	C 2,200	F 3,000	Pf 1,700	C	290			
Longview	4,200		C 2,200			C	75			
Pure Oil Co.:										
Nederland	55,000		C, V, R 15,200	T 9,800		T	800	2,000		
Rado Refining Co.:										
McAllen	2,000									
Republic Oil Refining Co.:										
Texas City	42,500	20,000	C 10,500	F 17,500	Pf 5,500	C	1,500			
Sid Richardson Refining Co.:										
Texas City	18,000		C, V 9,000		Cy 4,000					
Shamrock Oil & Gas Corp.:										
Sunray	12,000	2,500	C 2,000	Ho 5,900	Cy 1,500					S 450
Shell Oil Co.:										
Houston	125,000		C 31,000 R 14,000	F 35,000	Pf 12,000			3,100		S 500
Sinclair Refining Co.:										
Corpus Christi	28,000		C 7,000 R 3,000	Hy 12,000						
Houston	125,000	43,000	C 8,000 V 14,000 R 12,000	F 40,000 T 10,000				4,225		
Skelly Oil Co.:										
Longview	7,000		C 3,300		Pf 1,800	C	100			
Southwestern Oil & Ref. Co.:										
Corpus Christi	43,000	9,000		F 7,500	Cy 5,000	C	500			S 900
Standard Oil Co. of Texas:										
El Paso	30,000	10,000	C 8,000	Ho 14,000						

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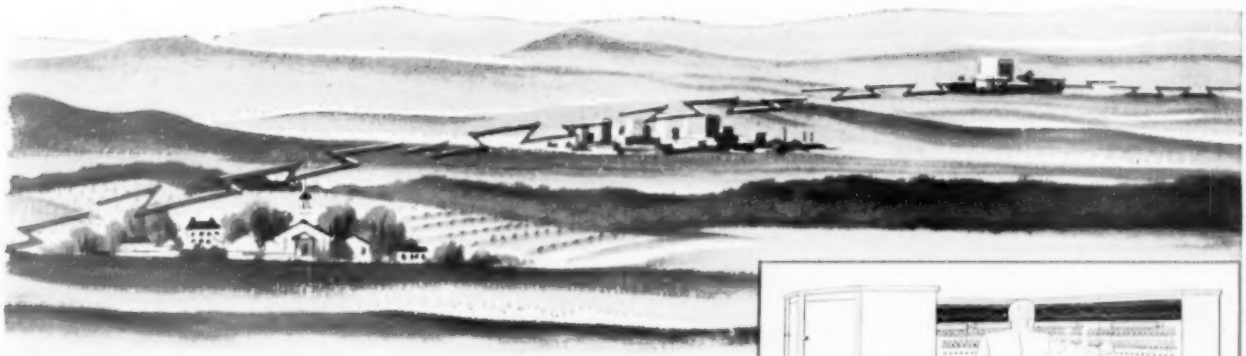

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Title .....

Company .....

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City & State .....

TEXAS (Continued)

	Charging, bbl. per stream day						Production			
	Crude oil	Vacuum dist.	Thermal operations	Cat. cr.	Cat. ref.		Poly.	Lubes	Coke, tons per day	Asphalt
Suntide Refining Co.:										
Corpus Christi	35,000	10,000		F 15,000		C	600			
Taylor Oil & Gas Co.:										
Corpus Christi	40,000		V 1,500	T 10,000	Pf 6,000	C	500			
Taylor Oil & Gas Co. and Mayfair Minerals, Inc. (Taylor Oil & Gas, Operator):										
Port Isabel	12,000				Pf 4,000					
Texas City Refining, Inc.:										
Texas City	40,000	10,000	V 4,000	Ho 17,500						
The Texas Co.:										
Amarillo	8,500		Ck 4,000			C	150		100	
El Paso	5,500		C 3,000							
Port Arthur	210,000	8,300	C 102,000 R 16,000 Ck 7,000	F 60,000		C	3,000	16,000	200	
Port Neches	40,000									S 5,450
Three Rivers Refinery:										
Three Rivers	1,500							750		O 200
Tydal Co.:										
Gainesville	2,000							200		
Wickett Refining Co.:										
Wickett	3,000		C 2,000							
Total	2,332,907	252,480	742,292	782,507	97,250		25,854	61,149	502	27,500

UTAH

Phillips Petroleum Co.:										
Woods Cross	12,000	3,000		T 8,000		C	400			S 800
Salt Lake Refining Co.:										
Salt Lake City	28,000	7,500		Ho 13,000						
Sure-Seal Corp.:										
Woods Cross	600	400								
Uinta Oil Refining Co.:										
Jensen	1,500									
Utah Oil Refining Co.:										
Salt Lake City	28,000		C 7,200	F 16,500				120		(*)
Western States Refining Co.:										
North Salt Lake	3,000		C 1,250							
Total	73,100	10,900	8,450	37,500			400	120		800

*Not reported.

WASHINGTON

American Bitumuls & Asphalt Co.:										
Richmond Beach		3,500								S 2,600
Union Oil Co. of California:										
Edmonds	4,440									(*)
Total	4,440	3,500								2,600

*Not reported.

WEST VIRGINIA

Elk Refining Co.:										
Falling Rock	4,500		C 1,500		Pf 1,500	C	100	1,500		
Pure Oil Co.:										
Cabin Creek	5,500		C, V, R 4,000			C	110	450		
Quaker State Oil Refining Corp.:										
St. Mary's	2,800		C 1,350					600		
Total	12,800		6,850		1,500		210	2,550		

WISCONSIN

Lake Superior Refining Co.:										
Superior	6,000	2,000	C 1,500							S 1,000 O 500
Wisconsin Oil Refining Co., Inc.:										
Sheboygan	5,000				Cy 1,000					
Total	11,000	2,000	1,500		1,000					1,500

WYOMING

C. & H. Refinery:										
Lusk	160									
Crook County Refinery:										
Sundance										S 125

WYOMING (Continued)

	Charging, bbl. per stream day					Production			
	Crude oil	Vacuum dist.	Thermal operations	Cat. cr.	Cat. ref.	Poly.	Lubes	Coke, tons per day	Asphalt
Continental Oil Co.:									
Glenrock	3,774		C 1,998			111			
Empire State Oil Co.:									
Thermopolis	5,000								
Frontier Refining Co.:									
Cheyenne	14,500	2,500	C 4,250	F 7,000	T	750			S 2,500
Husky Oil Co.:									
Cody	5,500				At. 1,500				S 1,000
Ohio Oil Co.:									
Lovell	6,000			Cy 700					S 1,800
Petroleum Operators Corp. (Formerly Resolute Oil Corp.):									
Badger Basin	1,000								
Pilot Oil Co.:									
Morton	250								
Sinclair Refining Co.:									
Sinclair	25,000	9,000	C 2,000 R 2,000	F 10,000	C	350			S 750
Sioux Oil Co.:									
Newcastle	2,500		C 1,500		C	50			
(Formerly Cooperative Ref. Assn.)									
Newcastle	1,750		C 850						
Socony-Vacuum Oil Co., Inc.:									
Casper	8,103	2,442		T 7,525	C	390			S 785
Standard Oil Co. (Ind.):									
Casper	20,300	6,000	C 4,450 Ck 2,500	F 8,750			650	118	S 105 O 26 M 1,685
The Texas Co.:									
Casper	17,000		Ck 4,000 R 1,500	F 6,000	C	500		100	S 1,090
Total	110,837	19,942	25,048	39,975	1,500	2,151	650	218	9,866

Sun, Continental, Standard (California), Union, Atlantic, Socony-Vacuum, Danaho, Gulf and Magnolia all reported on a calendar basis. Their figures were changed by dividing by nine tenths to a stream-day basis to balance the survey totals.

Shutdown Plants in the United States

CALIFORNIA

Company and plant location—	Cap., bbl. per day: Crude oil	Cracking
Aromalen, Inc., Long Beach	1,800	
Bankline Oil Co., Maricopa	5,000	
General Petroleum Corp., Vernon	4,000	
Harbor Refining Co., Long Beach	3,000	
Olympic Refining Co., Long Beach	5,500	
Thornsbury Drilling Co., Casmalia	3,500	
Westoil Terminals Co., San Pedro	25,000	

IDAHO

Phillips Petroleum Co., Pocatello	3,500	600

ILLINOIS

Ashland O&R Co., St. Elmo	5,000	2,500
Dupo Oil Refg. Co., Dupo	1,000	
Harmony Oil Corp., Salem	4,000	2,000

KENTUCKY

Gilley Oil & Refining Co., Betsey Layne	300	

LOUISIANA

Coast Oil Co., Cotton Valley	2,000	

MICHIGAN

Shamrock Oil & Refining Co., Saginaw	3,500	
Producers Refining, Inc., West Branch	3,500	

MONTANA

Harrison Green (formerly Hart Refining), Missoula	1,100	
Solar Oil & Refining Co., Hardin	1,500	

NEBRASKA

Company and plant location—	Cap., bbl. per day: Crude oil	Cracking
Searle Petroleum Co., Omaha	2,000	

OHIO

Ashland Oil & Refining Co., Niles	5,000	2,000

OKLAHOMA

Harper-Turner Oil Co., Oklahoma City	1,500	

PENNSYLVANIA

Quaker State Oil Refining Corp., Oil City	2,800	1,230

SOUTH DAKOTA

Hot Springs Refining Co., Hot Springs	200	
How Kola Refining Co., Sturgis	130	
Rex Oil Refining Co., Rapid City	200	

TEXAS

American Liberty Oil Co., Winnsboro	3,000	1,800
Jacksboro Refining Co., Jacksboro	250	
LaSalle Petroleum Corp., Burkburnett	1,500	
Levelland Consumers Cooperative Assn., Levelland	5,000	2,600
Patton Oil Co., Rotan	1,500	
W. T. Waggoner Estate, Electra	5,000	2,500

WYOMING

The Texas Co., Calpet	500	

EARLIER ON-STREAM TIME

IT'S PLAIN GOOD SENSE...

ACCURATE COST ESTIMATES

LOWER ENGINEERING COSTS

PURCHASING KNOW-HOW

PROVED CONSTRUCTION TECHNIQUES

EXPERIENCED FIELD CONSTRUCTION STAFFS

Results at R.J.'s new Platformer show advantages of

CONSTRUCTION BY PROCON

Throughout the petroleum refining industry, Procon has established an enviable record for getting processing units on stream faster, more efficiently and more economically.

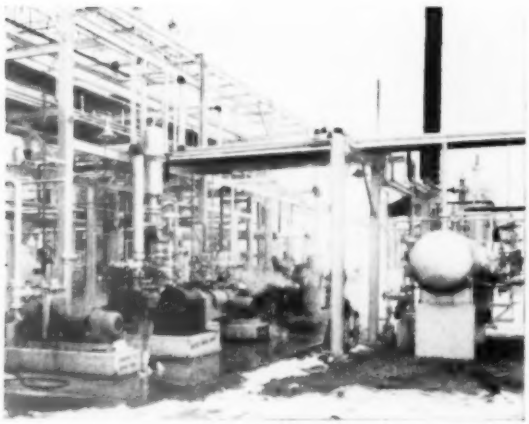
A good example is the 600 B/SD UOP Platforming unit constructed at the Princeton, Ind. refinery of the R. J. Oil and Refining Company, Inc.

One of the reasons why Procon built this unit with maximum speed and efficiency is that it implemented its "off-the-shelf" designs with construction service based on its wide experience gained from previous construction of UOP Platformers.

Any other refiner, like R. J., can benefit by choosing from this unusual stockpile of knowledge and designs the exact type of unit best suited to his particular needs.

Procon has available complete designs for UOP Platforming units ranging from 600 B/SD to 16,000 B/SD—"off-the-shelf" construction that means vital savings in time and costs.

IT'S PLAIN GOOD SENSE for any refiner to choose Procon when he wants the ultimate in ANY type of process construction.



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Report on Canadian Operating Refineries

Summary of Refineries in Canada—Their Distribution and Capacity

Province—	No. plants	Capacities, bbl. per stream day: Crude oil	Vacuum distillation	Thermal operations	Catalytic cracking	Catalytic reforming	Poly.	Lubes	Coke (tons)	Asphalt
Alberta	10	74,862	6,000	24,900	15,250	400	320		116	8,278
British Columbia	4	54,325	9,000	4,500	19,115		500			2,918
Manitoba	4	22,320		3,375	5,772					300
New Brunswick	1	300								
Northwest Territory	1	1,388								
Nova Scotia	1	24,420		11,100						1,034
Ontario	6	148,015	13,500	61,650	50,071	8,530		4,440	1,510	5,150
Quebec	4	183,060	31,000	45,673	65,800		8,234	300		6,530
Saskatchewan	10	61,870	11,500	19,606	12,100		1,590		90	3,463
Total	10	570,560	71,000	170,804	168,108	8,930	10,644	4,740	1,716	27,673

ALBERTA

	Charging, bbl. per stream day: Crude oil	Vacuum dist.	Thermal operations	Cat. cr.	Cat. ref.	Production: Poly.	Lubes	Coke, tons per day	Asphalt
Anglo-American Exploration, Ltd. (Formerly Gas & Oil Refineries, Ltd.):									
Hartell	3,000		C 1,500			C 70			
Bonnyville Oil Refineries:									
Bonneville	1,000 est.								
British American Oil Co., Ltd:									
Calgary	7,200	2,500	C 2,500						240
Edmonton	7,200		C 1,400 Ck 2,100	F 2,000				56	
Excelsior Refineries, Ltd.:									
Lloydminster	2,500	1,500							S 1,200 O 200
Husky Oil & Refining, Ltd.:									
Lloydminster	7,500	1,400			Cy 400				S 3,500 O 1,000 M 500
Imperial Oil, Ltd:									
Calgary	10,212		C 5,100						738
Edmonton	27,750		C 10,100	F 10,650					
McColl-Frontenac Oil Co., Ltd.:									
Edmonton	7,000		Ck 2,200	F 2,600		C 250		60	
Wainwright Producers & Refiners, Ltd.:									
Wainwright	1,500	600							S 900
Total	74,862	6,000	24,900	15,250	400	320		116	8,278

BRITISH COLUMBIA

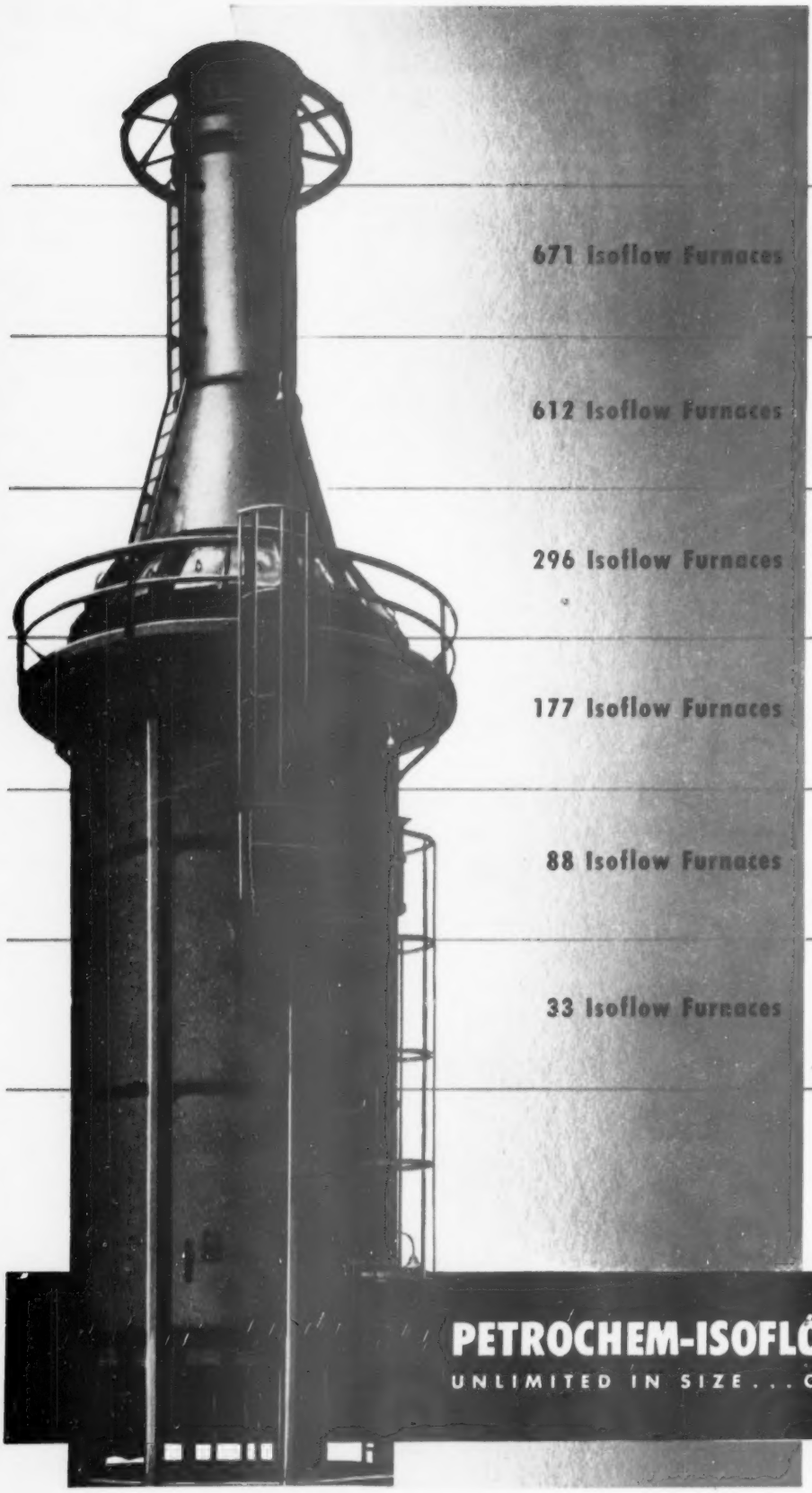
Imperial Oil, Ltd.:									
Ioco	24,975			F 12,765					668
Royalite Products, Ltd.:									
Kamloops	5,000	2,000		F 1,350		C 100			S 500
Shell Oil Co. of Canada, Ltd.:									
N. Burnaby	16,000	7,000	V 3,000 R 1,500	F 5,000		C 400			S 550
Standard Oil Co. of B. C., Ltd.:									
N. Burnaby	8,350								S 1,200
Total	54,325	9,000	4,500	19,115		500			2,918

MANITOBA

Anglo-Canadian Oils, Ltd.:									
Brandon	3,000		C 1,375			C 50			
Imperial Oil, Ltd.:									
Winnipeg	13,320			5,772					300
North Star Oil, Ltd.:									
St. Boniface	5,000		C 1,000 R 1,000						
Radio Oil Refineries, Ltd.:									
E. Kildonan	1,000 est.								
Total	22,320		3,375	5,772					300

	Charging, bbl. per stream day					Production			
	Crude oil	Vacuum dist.	Thermal operations	Cat. cr.	Cat. ref.	Poly.	Lubes	Coke, tons per day	Asphalt
NEW BRUNSWICK									
New Brunswick Oilfields, Ltd.:									
Weldon	300								
NORTHWEST TERRITORY									
Imperial Oil, Ltd.:									
Norman Wells	1,388								
NOVA SCOTIA									
Imperial Oil, Ltd.:									
Halifax	24,420		C 11,100						1,034
ONTARIO									
British American Oil Co., Ltd.:									
Clarkson	17,000	6,000	C 4,500					1,200	2,200
Canadian Oil Refineries, Ltd.:									
Corunna	25,000	7,500	C 3,000	F 10,000	Pf 4,000	C 1,200			
Imperial Oil, Ltd.:									
Sarnia	79,365		C 4,440 V 4,440 R 8,880 Ck 32,190	F 27,861			4,440	310	2,950
Riverlake Oils, Ltd.:									
Fort Williams	2,500				Cy 1,200				
Sun Oil Co.:									
Sarnia	16,650			Hf 12,210	Ho 3,330				
Trinidad Leaseholds (Canada), Ltd.:									
Port Credit	7,500		C 3,500 R 700						
Total	148,015	13,500	61,650	50,071	8,530	1,200	4,440	1,510	5,150
QUEBEC									
British American Oil Co., Ltd.:									
Montreal East	45,000	12,000	C 3,500	F 17,500		C 750	300		3,200
Imperial Oil, Ltd.:									
Montreal East	51,060		C 11,655 R 4,218	F 16,300		C 4,884			3,330
McColl-Frontenac Oil Co., Ltd.:									
Montreal East	43,000		C 4,200 V 9,600 R 4,500	F 16,000		C 1,500			
Shell Oil Co. of Canada, Ltd.:									
Montreal East	44,000	19,000	C, V, R 8,000	F 16,000		C 1,100			
Total	183,060	31,000	45,673	65,800		8,234	300		6,530
SASKATCHEWAN									
British American Oil Co., Ltd.:									
Moose Jaw	15,000	5,000	C 1,500 Ck 2,500	F 4,500		C 500		90	435
Consumers Co-Operative Refineries, Ltd.:									
Regina	12,000	6,500		F 5,000		C 500			
Hi-Way Refineries, Ltd.:									
Moose Jaw	350								
Rosetown	350								
Saskatoon	6,500		V 3,840	F 2,600		C 260			S 600
Imperial Oil, Ltd.:									
Regina	18,870		11,766			C 330			428
Moose Jaw Refineries, Ltd.:									
Moose Jaw	2,000								1,000
Northern Petroleum Corp., Ltd.:									
Kamsack	800								
Prince Albert Refineries, Ltd.:									
Prince Albert	1,000								
Royalite Products, Ltd.:									
Coleville	5,000								S 1,000
Total	61,870	11,500	19,606	12,100		1,590		90	3,463

Where not specifically coded, asphalt production in Canada includes straightrun, oxidized, and other types.



671 Isoflow Furnaces — specified by 65 contractors

612 Isoflow Furnaces — installed by 120 Oil Refining Companies

296 Isoflow Furnaces — installed by 62 Chemical Manufacturers

177 Isoflow Furnaces — installed by 52 Field Processing Gasoline Companies

88 Isoflow Furnaces — installed by 25 Pipe Line Companies

33 Isoflow Furnaces — installed by 14 air heating and steam generating Utilities

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uniform heat distribution • minimum ground space
short length of liquid travel
excess draft for high overload
proper proportions • simplicity

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explosion resistant • maximum prefabrication
plenum chambers for hazardous areas

PERFORMANCE

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PETROCHEM-ISOFLOW FURNACES ARE BEST BY ANY COMPARISON

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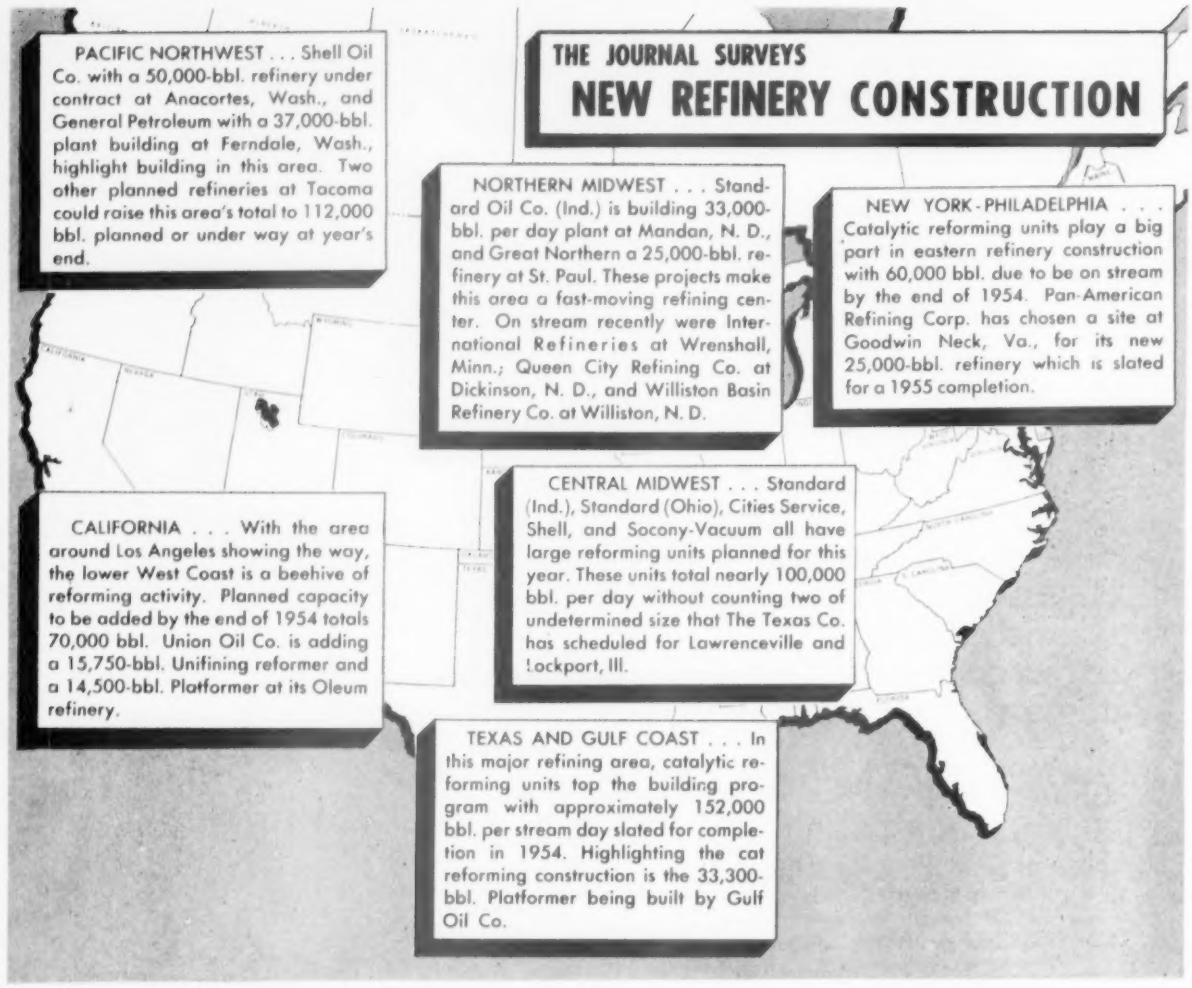

THE JOURNAL SURVEYS
NEW REFINERY CONSTRUCTION
PACIFIC NORTHWEST . . . Shell Oil Co. with a 50,000-bbl. refinery under contract at Anacortes, Wash., and General Petroleum with a 37,000-bbl. plant building at Ferndale, Wash., highlight building in this area. Two other planned refineries at Tacoma could raise this area's total to 112,000 bbl. planned or under way at year's end.
NORTHERN MIDWEST . . . Standard Oil Co. (Ind.) is building 33,000-bbl. per day plant at Mandan, N. D., and Great Northern a 25,000-bbl. refinery at St. Paul. These projects make this area a fast-moving refining center. On stream recently were International Refineries at Wrenshall, Minn.; Queen City Refining Co. at Dickinson, N. D., and Williston Basin Refinery Co. at Williston, N. D.
NEW YORK-PHILADELPHIA . . . Catalytic reforming units play a big part in eastern refinery construction with 60,000 bbl. due to be on stream by the end of 1954. Pan-American Refining Corp. has chosen a site at Goodwin Neck, Va., for its new 25,000-bbl. refinery which is slated for a 1955 completion.
CENTRAL MIDWEST . . . Standard (Ind.), Standard (Ohio), Cities Service, Shell, and Socony-Vacuum all have large reforming units planned for this year. These units total nearly 100,000 bbl. per day without counting two of undetermined size that The Texas Co. has scheduled for Lawrenceville and Lockport, Ill.
CALIFORNIA . . . With the area around Los Angeles showing the way, the lower West Coast is a beehive of reforming activity. Planned capacity to be added by the end of 1954 totals 70,000 bbl. Union Oil Co. is adding a 15,750-bbl. Unifining reformer and a 14,500-bbl. Platformer at its Oleum refinery.
TEXAS AND GULF COAST . . . In this major refining area, catalytic reforming units top the building program with approximately 152,000 bbl. per stream day slated for completion in 1954. Highlighting the cat reforming construction is the 33,300-bbl. Platformer being built by Gulf Oil Co.

New Construction Boosts Capacity ⅓ Million Barrels

by John M. McGivern

CATALYTIC reforming, the refining industry's youngest major process, shows signs of growing up in record time, according to The Oil and Gas Journal's 1954 refinery construction survey.

Refiners in the United States have shown their faith in reforming by scheduling an increase of approximately 500,000 bbl. per stream day in capacity.

Catalytic cracking, rated 11 times greater in capacity at present than reforming, will lose more than 150,000 bbl. of this advantage. Construction scheduled for catalytic cracking in 1954 is 340,695 bbl. daily.

The bulk of catalytic cracking building is being constructed by six companies: Gulf Oil Corp.; Pure Oil Co.; Socony-Vacuum Oil Co., Inc.; Shell Oil Co.; Atlantic Refining Co., and Standard Oil Co. of California. Gulf is adding the most capacity at its Philadelphia refinery by increasing its present fluid cracker by 66,600 bbl. daily.

Gulf also is building the largest reforming unit. Its Port Arthur, Tex., refinery is at work on a Platformer which will have a capacity of 33,300 bbl. Standard Oil Co. (Ind.), is adding a 30,000-bbl. Hydroformer to its refinery at Whiting, Ind. Pan-American Refining Corp. has a 21,000-bbl. Ultraformer planned for its Texas City plant, and The Texas Co. will build a 20,000-bbl. Platformer at Port Arthur.

Other large units being built or scheduled for building in 1954 are: Magnolia Petroleum Co., 17,000-bbl. Thermofor at Beaumont, Tex.; Gulf at Philadelphia; Phillips Petroleum Co. at Swenny, Tex., and Shell at Wood River, Ill., all are adding 16,000-bbl. Platformers. Sinclair Refining Co. is building a reforming unit of its own design at its Marcus Hook, Pa., plant.

Crude capacity gained 357,831 bbl. daily during the preceding year and if all construction planned for 1954 is fulfilled, capacity will increase by 475,000 bbl. during 1954.

If this gain is realized, crude capacity in the United States at the beginning of 1955 will be within 75,000 bbl. per stream day of 9,000,000 bbl.

Building within this category in 1954 is slated for a slight increase, as several new coking units are being added. However, the retirement of old units is expected to overcome any building and leave the total at about its present level.

Geographically, the Pacific Northwest is the center of new refinery building. Shell has broken ground on its new 50,000-bbl. refinery at Anacortes, Wash., and General Petroleum Corp. will go on stream in December with its 37,000-bbl. plant which will include a 6,000-bbl. Sovaformer, Socony-Vacuum's newest and the industry's newest reformer.

ACTIVE REFINERY-BUILDING PROJECTS

A

Company, location of refinery and type of project—	Capacity rating (Bbl. per stream day)	Completion schedule
Anderson-Prichard Oil Corp., Cyril, Okla.:		
Planning Atlantic reformer	1,110	
Anglo American Exploration, Ltd., Hartell, Alta., Canada:		
Planning increase in crude-distillation capacity	1,000	1954
Atlantic Refining Co. (Philadelphia):		
Increase in crude capacity	21,534	1954
Increase in fluid cat cracking capacity	33,300	1954
Atlantic Refining Co. (Port Arthur, Tex.):		
Adding Atlantic reforming unit	7,992	1954

B

Bay Refining Corp., Bay City, Mich.:		
Adding Thermofor cat cracker	6,000	10- 1-54
Adding catalytic polymerization unit	300	10- 1-54
British American Oil Co., Ltd., Clarkson, Ont., Canada:		
Adding fluid cat cracker	11,600	6- 1-54
Building catalytic polymerization unit	1,260	6- 1-54
Berry Asphalt Co., Gary, Ind.:		
Adding vacuum-distillation unit	2,500	6- 1-54
Adding straightrun asphalt capacity	600	6- 1-54

C

California Oil Co., Barber, N. J.:		
Planning addition to crude capacity	4,000	
Converting thermal reforming unit to Platformer	10,000	
Planning Houdriflow cat cracker	3,000	
Calstate Refining Co., Long Beach, Calif.:		
Planning to increase thermal cracking operation	500	
To add Hyperformer	1,100	
Carter Oil Co., Billings, Mont.:		
Adding to atmospheric-distillation unit	5,000	1- 1-56
Adding fluid-type coking unit	3,800	10- 1-54
Increasing fluid cat cracker	10,000	10- 1-54
Adding coke output (tons)	150	10- 1-54
Cities Service Oil Co., East Chicago, Ind.:		
Increasing atmospheric distillation unit	12,000	12- 1-54
Adding fluid-type Hydroformer	11,500	12- 1-54
Cities Service Oil Co. (Pa.), Linden, N. J.:		
Adding vacuum-distillation unit		1954
Cities Service Refining Corp., Lake Charles, La.:		
Adding to atmospheric distillation unit	20,000	1954
Building vacuum distillation unit	26,000	1954
Increasing fluid cat cracking unit	9,000	1954
Building fluid-type Hydroformer	15,000	1954
Continental Oil Co., Ponca City, Okla.:		
Adding to delayed-coking unit	5,883	9- 1-54
Building Platformer	8,880	5- 1-54
Crown Central Petroleum Co., Houston:		
Planning Houdriforming unit	5,000	

D

Dakota Oil & Refining Co., Minot, N. D.:		
(New refinery proposed)		
Danaho Refining Co., Pettus, Tex.:		
Adding to atmospheric distillation unit	8,325	10- 1-54
Adding to Thermofor catalytic cracker	3,885	12- 1-54
Adding to catalytic polymerization unit	260	12- 1-54
Derby Oil Co., Wichita, Kans.:		
Planning at Platformer		

E

Esso Standard Oil Co., Baton Rouge, La.:		
Adding to fluid catalytic cracking	13,000	8- 1-54
Building fluid-type Hydroformer	27,860	11-15-54
Esso Standard Oil Co., Everett, Mass.:		
Building vacuum-distillation unit	13,500	6- 1-54
Esso Standard Oil Co., Linden, N. J.:		
Adding to vacuum-distillation unit	23,800	8- 1-54
Adding to catalytic polymerization unit	2,800	3-31-55

F

Company, location of refinery and type of project—	Capacity rating (Bbl. per stream day)	Completion schedule
Famariss Oil & Refining Co., Monument, N. M.:		
Adding to atmospheric distillation unit	2,200	1954
Building Platformer	750	1954
Fletcher Oil Co., Wilmington, Calif.:		
Platformer planned to be built	2,500	8- 1-54

G

General Petroleum Corp., Ferndale, Wash.:		
(Complete refinery to be on stream in December 1954)		
Atmospheric distillation	37,000	
Vacuum distillation	10,000	
Visbreaking thermal unit	6,600	
Thermofor catalytic cracker	20,000	
Sovaformer	6,000	
Catalytic polymerization unit	1,000	
General Petroleum Corp., Torrance, Calif.:		
Building Thermofor catalytic reforming unit	19,000	7- 1-54
Gilmore Refineries, Inc., Odessa, Tex.:		
(New refinery proposed)	50,000	
Globe Oil & Refining Co., Lemont, Ill.:		
Adding to atmospheric unit	3,000	8- 1-54
Increasing vacuum-distillation unit	16,000	
Increasing fluid catalytic cracker	10,000	8- 1-54
Great Northern Oil Co., St. Paul:		
To begin building new refinery in spring	25,000	
Gulf Oil Corp., Philadelphia:		
Adding to atmospheric-distillation unit	84,300	1954
Increasing fluid catalytic cracker	66,600	1954
Building Platformer	17,760	1954
Building catalytic polymerization unit	3,996	1954
Gulf Oil Corp., Port Arthur, Tex.:		
Building Platformer	33,300	1954
Building catalytic polymerization unit	3,996	1954
Gulf Refining Co., Toledo:		
Building Platformer	11,100	1954

H

Hancock Oil Co., Signal Hill, Calif.:		
Adding Thermofor catalytic cracking unit	6,000	
Building catalytic polymerization unit	500	
Humble Oil & Refining Co., Baytown, Tex.:		
Adding to atmospheric distillation unit	33,000	8- 1-54
Building catalytic polymerization unit	4,500	8- 1-54
Husky Oil & Refining, Ltd., Lloydminster, Alta., Canada:		
Adding to atmospheric-distillation unit	2,500	1954
Increasing Cycloversion catalytic reforming unit	800	1954

I

Imperial Oil, Ltd., Halifax, N. S.:		
Planning new refinery for completion in 1955-1956.		
Atmospheric-distillation unit	46,203	1955-56
Fluid catalytic cracking unit	36,600	1955-56
Imperial Oil, Ltd., Edmonton, Alta., Canada:		
Building unit to produce lube oils	2,220	1955

K

Kerr-McGee Oil Industries, Inc., Wynnewood, Okla.:		
Adding to atmospheric distillation unit	6,000	4-15-54
Adding to vacuum-distillation unit	2,800	4-15-54
Increasing fluid catalytic cracker	6,000	11- 1-54
Adding to catalytic polymerization unit	450	11- 1-54
Adding to straightrun asphalt capacity	1,500	4-15-54

M

Magnolia Petroleum Co., Beaumont, Tex.:		
Building Thermofor catalytic reforming unit	18,870	12- 1-54
McColl-Frontenac Oil Co., Ltd., Edmonton, Alta., Canada:		
Adding to atmospheric distillation unit	4,000	1954
Building thermal cracking unit	3,000	1954

Company, location of refinery and type of project—	Capacity rating (Bbl. per stream day)	Completion schedule
Mid-Continent Petroleum Corp., Tulsa:		
Building an Atlantic cat reforming unit	7,500	7- 1-54
Mid-West Refineries, Inc., Alma, Mich.:		
Adding to thermal-cracking unit	600	1954
Adding to Platformer	400	1954
Modern Oil Co., Shelby, Mont.:		
Adding to atmospheric-distillation unit	1,000	1954
Mohawk Petroleum Corp., Bakersfield, Calif.:		
Building Atlantic reforming unit	2,500	5-15-54

N

Newhall Refining Co., Newhall, Calif.:		
Building Cycloversion catalytic cracking unit	1,000	1954
North Star Oil, Ltd., St. Boniface, Man., Canada:		
Planning atmospheric distillation unit	8,000	
Planning Platforming catalytic reforming unit	8,000	
Northwestern Refining Co., St. Paul Park, Minn.:		
Adding to atmospheric-distillation unit	12,000	1954

P

Pacific Oil & Refining Co., Tacoma:		
(Construction due to start in 1954 on new refinery)		
Will have atmospheric distillation unit		
Catalytic cracker, type unknown	12,000	
Pan American Refining Corp., Goodwin Neck, Va.:		
(Construction started on new 25,000-bbl. refinery)	25,000	1955
Pan American Refining Corp., Texas City, Tex.:		
Building Ultraformer	21,000	1954
Pan-Am Southern Corp., El Dorado, Ark.:		
Building Ultraformer	7,200	7- 1-54
Paragon Oil Co., Newark, N. J.:		
Planning complete refinery	20,000	
Petroleum Specialties, Inc., Flat Rock, Mich.:		
Building visbreaking thermal processing unit	2,000	1954
Phillips Petroleum Co., Sweeny, Tex.:		
Adding Platformer	16,000	1954
Pontiac Refining Corp., Corpus Christi, Tex.:		
Building Platformer	5,000	8- 1-54
Port Fuel Co., Inc., Brownsville, Tex.:		
Adding to atmospheric-distillation unit	7,500	6-15-54
Adding visbreaking thermal processing unit	4,500	6-15-54
Building Atlantic catalytic reforming unit	1,000	9-15-54
Planning straightrun asphalt addition	500	
Prime Oil Co., Calumet City, Ill.:		
Proposed new refinery	15,000	
Proven Oil & Refining Co., Florence, Ariz.:		
(New refinery proposed)		
Pure Oil Co., Toledo:		
Adding to atmospheric distillation unit	10,000	1954
Pure Oil Co., Newark, Ohio:		
Adding to atmospheric distillation unit	2,000	6- 1-54
Building Kellogg reforming unit	3,000	6- 1-54
Pure Oil Co., Nederland, Tex.:		
Adding to atmospheric-distillation unit	12,000	Spring '54
Building fluid catalytic cracker	17,750	Spring '54
Adding catalytic polymerization unit	825	Spring '54

Q

Quaker State Oil Refining Corp., Emlenton, Pa.:		
Building Platformer	850	8- 1-54
Quaker State Oil Refining Corp., Farmers Valley, Pa.:		
Building Platformer	1,500	5- 1-54
Quaker State Refining Corp., St. Marys, W. Va.:		
Building Platformer	850	8- 1-54

R

R. & J. Oil & Refining Co., Princeton, Ind.:		
Building thermal process cracking unit	1,500	1954
Rock Island Refining Corp., Rock Island, Ind.:		
Adding Platformer	1,800	6- 1-54

S

Company, location of refinery and type of project—	Capacity rating (Bbl. per stream day)	Completion schedule
Salt Lake Refining Co., Salt Lake City:		
Adding propane treater to remove carbonyl sulfide and sulfur	260	1954
Shell Oil Co., Anacortes, Wash.:		
Building complete refinery. Work started December 1953	50,000	1955
Shell Oil Co., Martinez, Calif.:		
Adding Platformer	4,500	7- 1-54
Shell Oil Co., Norco, La.:		
Adding to atmospheric-distillation unit	25,000	7- 1-54
Building fluid catalytic cracking unit	48,000	7- 1-54
Adding to catalytic polymerization unit	1,300	7- 1-54
Shell Oil Co., Wood River, Ill.:		
Building Platformer	16,000	6- 1-54
Adding to catalytic polymerization unit	350	6- 1-54
Sinclair Refining Co., Marcus Hook, Pa.:		
Building Sinclair reforming unit	16,000	
Skelly Oil Co., El Dorado, Kans.:		
Building Platformer	7,500	1954
Socony-Vacuum Oil Co., Inc., Augusta, Kans.:		
Building Sovaforming catalytic reforming unit	3,000	9- 1-54
Socony-Vacuum Oil Co., Inc., Paulsboro, N. J.:		
Building unit to manufacture catalyst		4- 1-54
Socony-Vacuum Oil Co., Inc., E. St. Louis, Ill.:		
Adding Thermofor catalytic cracking unit	16,000	9- 1-54
Adding catalytic polymerization unit		9- 1-54
Socony-Vacuum Oil Co., Inc., Trenton, Mich.:		
Adding catalytic polymerization unit		Spring '54
Standard Oil Co. of British Columbia, Ltd., North Burnaby, B. C., Canada:		
Adding to atmospheric-distillation unit	11,000	10- 1-54
Building fluid catalytic cracking unit	3,700	10- 1-54
Adding catalytic polymerization unit	800	10- 1-54
Increasing straightrun asphalt	1,200	10- 1-54
Standard Oil Co. of Calif., El Segundo, Calif.:		
Adding vacuum distillation	54,000	1954
Building fluid catalytic cracking unit	39,960	1954
Standard Oil Co. (Ind.), Wood River, Ill.:		
Building Ultraformer	9,000	10- 1-54
Standard Oil (Ind.), Mandan, N. D.:		
(New refinery under construction)		
Atmospheric distillation	33,000	10- 1-54
Fluid catalytic cracking unit	12,500	10- 1-54
Catalytic polymerization unit	4,365	10- 1-54
Standard Oil Co. (Ind.), Whiting, Ind.:		
Adding fluid Hydroformer	30,000	1955
Increasing lube-oil capacity	540	1954
Standard Oil Co. (Ohio), Cleveland:		
Increasing Thermofor catalytic cracking unit	3,000	Late 1954
Standard Oil Co. (Ohio), Toledo:		
Adding to atmospheric-distillation unit	2,000	Mid 1954
Increasing catalytic polymerization unit	200	Mid 1954
Standard Oil Co. (Ohio), Lima, Ohio:		
Building Platformer	12,000	Mid 1954
Adding to thermal polymerization unit	200	Late 1954
Sunray Oil Corp., Duncan, Okla.:		
Building delayed-type coking unit	9,000	10- 1-54
Adding Platformer	5,000	9- 1-54
Adding coke production (tons)	375	
Sunray Oil Corp., Santa Maria, Calif.:		
Adding vacuum distillation	1,500	4- 1-54

T

The Texas Co., Amarillo, Tex.:		
Building fluid catalytic cracking unit		1954
Adding Platformer	4,800	1954
Adding thermal coking unit		1954
The Texas Co., El Paso, Tex.:		
Adding fluid catalytic cracking unit		1954
Building Platformer	3,330	1954
Adding thermal coking unit		1954
The Texas Co., Lawrenceville, Ill.:		
Adding a Platformer		1954
The Texas Co., Lockport, Ill.:		
Adding a Platformer		1954

Company, location of refinery and type of project—	Capacity rating (Bbl. per stream day)	Completion schedule
The Texas Co., Port Arthur, Tex.:		
Adding a Platformer	20,000	1954
The Texas Co., Sunburst, Mont.:		
Adding a polymerization unit		1954
The Texas Co., West Tulsa, Okla.:		
Adding a Platformer	6,000	1954
The Texas Co., Westville, N. J.:		
Adding a Platformer	11,970	1954
The Texas Co., Wilmington, Calif.:		
Adding a Platformer		1954
Tide Water Associated Oil Co., Avon, Calif.:		
Adding to vacuum-distillation unit	22,000	Fall 1954
Building Platformer	10,000	Late 1954
Trans-Marine Oil Refining Corp., South Milwaukee, Wis.:		
(Refinery still in planning stage).		
Trinidad Leaseholds (Canada), Ltd., Port Credit, Ont., Canada:		
Building Platformer	1,500	7- 1-54
U		
Union Oil Co. of California, Cut Bank, Mont.:		
Building Atlantic reforming unit	600	9- 1-54
Union Oil Co. of Calif., Oleum, Calif.:		
Building Platformer	14,500	11- 1-54
Increasing grease-manufacturing capacity		10- 1-54
Building Unifining unit	15,750	12- 1-54
V		
Vickers Petroleum Co., Inc., Potwin, Kans.:		
Considering straightrun asphalt	500	1954
W		
Washington Processing Co., Tacoma:		
(Planned new refinery to process crude from Trans-Mountain Pipe Line)		
Atmospheric distillation	10,000	
Wainwright Producers & Refiners, Ltd., Wainwright, Alta., Canada:		
(Part of plant destroyed by fire, January 12, 1954. Destroyed part to be rebuilt. See capacity table for prefire capacity.)		

Shutdown Plants in Canada

	Cap., bbl. per day	
	Crude oil	Cracking
Home Oil Distributors, Ltd., Vancouver, B. C.	**2,000**	
Lion Refining Co., Calgary, Alta.	**750**	
Trump Oil Co., Morris, Man.	**300**	
Total	**3,050**	

Summary of Refineries in Mexico

	No. plants	Cap., bbl. per day	
		Crude oil	Cracking
Distrito Federal	**1**	**60,000**	
Guanajuato	**1**	**40,000**	**4,500**
Tamaulipas	**3**	**98,000**	**20,500**
Veracruz	**3**	**43,000**	**6,000**
Total	**8**	**241,000**	**31,000**

THOMPSON *unitized* VACUUM TANKS for *MODERN* Refineries!

More and more refiners, seeking efficient methods, are using Thompson Unitized Vacuum Tanks. For moving liquids and semi-solids, they're first in the field—with no second!

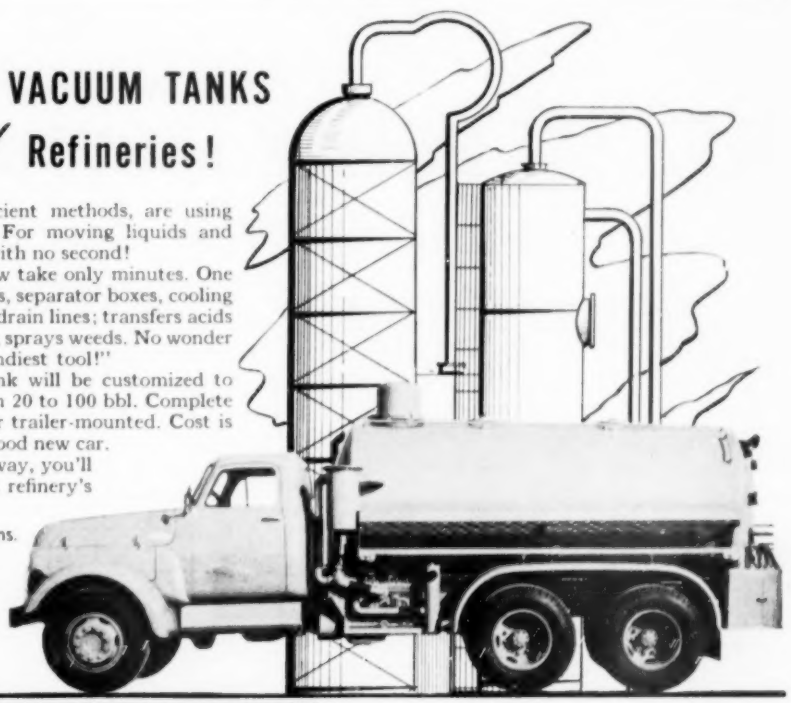
Jobs which used to require hours now take only minutes. One driver-operator cleans tanks, drainboxes, separator boxes, cooling tower basins, spills, and leaks; unplugs drain lines; transfers acids and caustics; oils roads and tank bunds; sprays weeds. No wonder the Thompson UVT is called "the handiest tool!"

A Thompson Unitized Vacuum Tank will be customized to meet your needs. Capacities range from 20 to 100 bbl. Complete units can be skid, truck, semi-trailer or trailer-mounted. Cost is about what you'd expect to pay for a good new car.

If you are searching for tomorrow's way, you'll want to know more about the modern refinery's handiest tool.

Write today for complete specifications.

This is a 45-bbl. Thompson Unitized Vacuum Tank mounted on a GMC truck. This complete, mobile unit, operated by one man provides speed and economy for a host of liquid and semi-solid handling jobs at the world's most modern refinery.



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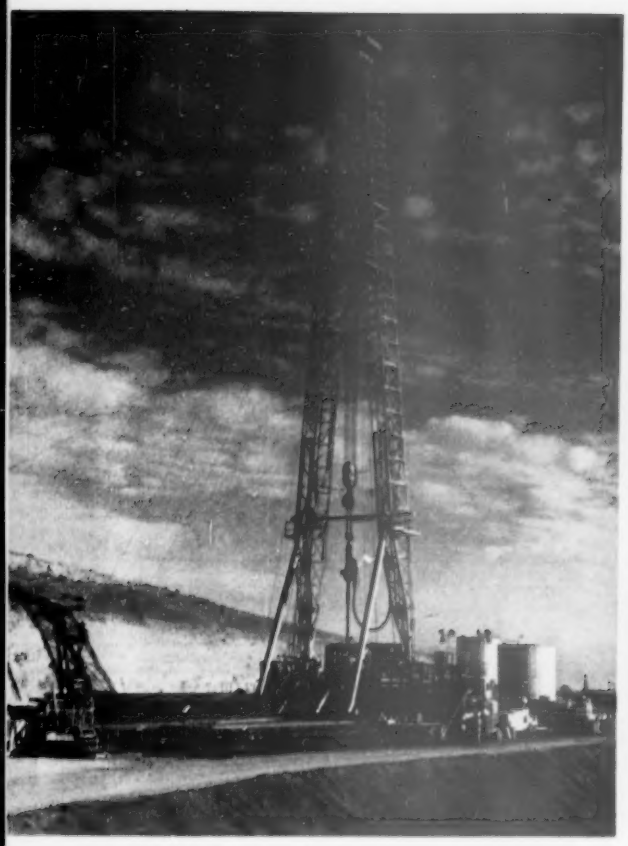
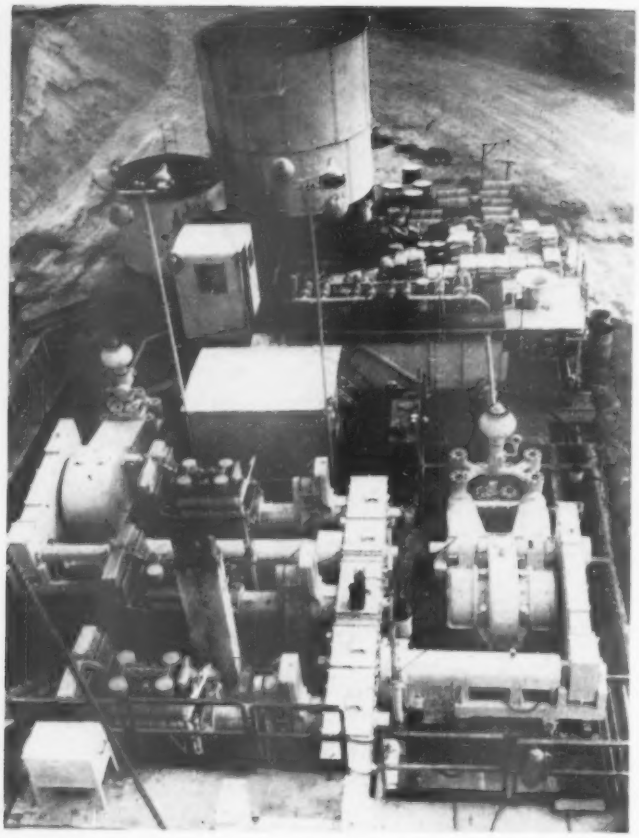


FIRST TWO LOCATIONS for the new Shell rig were in the hilly Brea Canyon area. When short moves are made on level areas it is planned to skid rig with mast erected.



LOOKING DOWN on the compact arranged rig. Universal shafts connect the engines to the converter-compound skid and power to the two mud pumps is through two other universal joints.

FLEXIBLE POWER FLOW . . .

features Shell's new rig in Brea Canyon . . . compact packaging aids quick moves

by D. H. Stormont
West Coast Editor

A NEW Shell Oil Co. rig in Brea Canyon field is attracting attention of Los Angeles Basin drilling engineers because of its great flexibility of power flow and its compact, well-unitized layout.

Ease with which the flow of power from the central plant can be applied either to hoisting or mud-pump operation is a chief point of interest. There are no idle engines on this 1,200-hp. rig as is frequently the case in medium-heavy and larger rigs.

To obtain the large-volume, high-pressure mud circulation needed in modern drilling techniques, special attention was devoted to the hydraulic system. The rig's design, as well as drilling practices employed, make for maximum hydraulic horsepower at the bit.

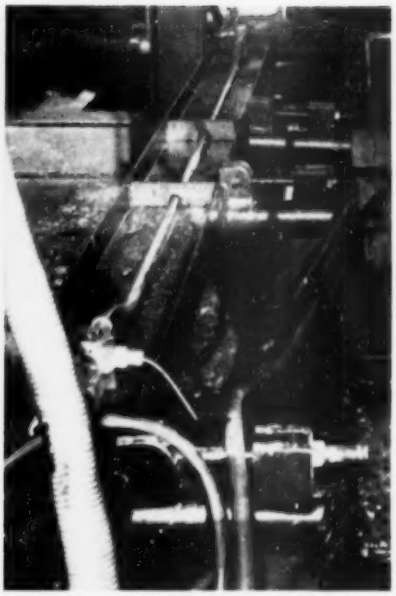
The rig's packaging and arrangement are such as to facilitate rapid moves and ease of maintenance. An unusual feature is the unitizing of the engine exhaust manifolding into the power-package skid and the use of an exhaust stack common to all engines.

That the rig will act as a pace setter in Shell's Brea drilling is shown by its initial performance. Drilling time for the two wells completed to date was about 20 per cent faster than that of any other in the field. An average of 200 to 300 ft. per day was drilled despite an extensive testing and coring program.

Engine layout . . . The rig is of the two-level type, powered by four in-line V-12 gas engines placed at ground level. The engines drive through torque converters into a tandem plate-type chain compound mounted on a separate skid. The compound is equipped with power takeoffs for the draw works and two mud pumps, and with the necessary air and splined clutches for power flexibility.

The power plant is composed of two skid-mounted packages, each 8 ft. wide

BECAUSE ALL LINES possible are unitized in the two subbases, an exceptionally clean and readily accessible working area is offered.



CORRECT ALIGNMENT and rapid assembly of engine and converter-compound skids to subbases is assured by cup-and-cone locating connections.

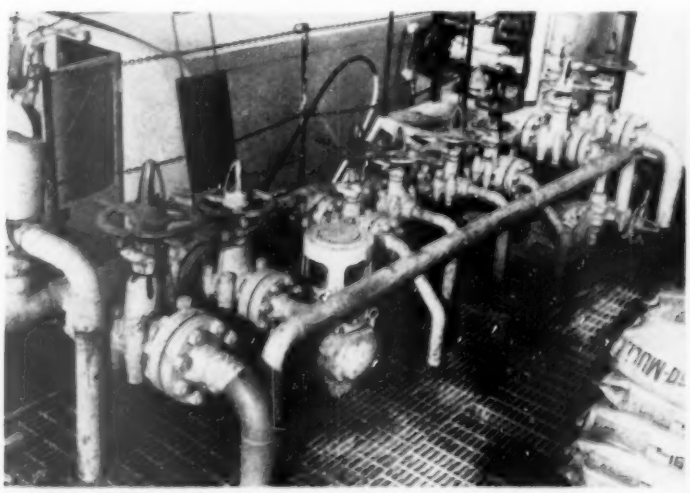
by 31 ft. long. The four engines form one skid; the torque converters, air clutches, and compound transmission make up the other (see diagram). The two packages sit side by side at rig grade level and are joined by universal joints which drive from the engine flywheels to the converter input shaft. Removal of the four universal drives separates them into two legal-size skids for movement over public highways.

This location of the universal drives is near ideal in that the joints are not subjected to torque multiplication. Another advantage of this location is that the joints rotate at a relatively constant speed.

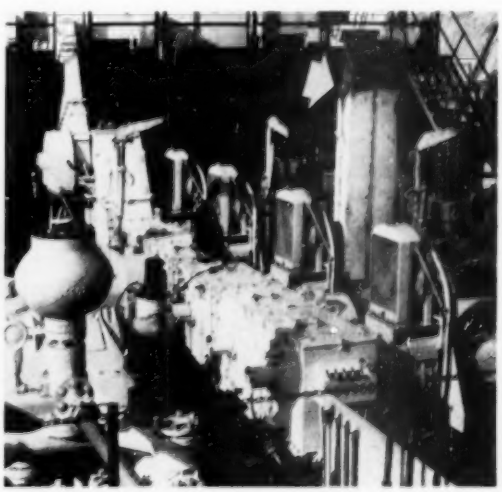
Universal joints also are used to drive the two mud pumps, rated at 500 input horsepower, which with their unitized chain drives also set at ground level. One power takeoff is located between Nos. 2 and 3 engine shafts and drives the road-side pump. Takeoff for the ditch-side pump is located between engine shafts Nos. 3 and 4. The drives to both pumps are ratioed so they can be operated at 70 to 80 s.p.m.

While the forward engine drives the rotary table, three engines can be used to power the mud pumps; 900 hp. on either pump or to both pumps in parallel, or 600 hp. on either pump and 300 hp. on the other. Or if desirable two engines can be placed on the rotary and two engines used on either pump. During hoisting operations one to four engines—300 to 1,200 hp.—can be used to power the draw works. Plan view of the rig is shown in Fig. 1.

This flow of power is readily controlled from the driller's console once the manually operated splined clutches in the compound transmission are properly positioned. In addition a panel with controls for the four engine and two pump air clutches is located at the mud-pit end of the compound package. This safety feature allows the mechanic or derrick man to disengage any engine



MUD MANIFOLD mounted on suction pit permits mud to be discharged to standpipe, kill line, mud-storage tank, or to the bleeder line. Motor-driven mud agitators likewise are unitized in the pits.



EXHAUST LINES from all four engines are unitized in the engine skid and feed into the common stack (shown by arrow).

or pump from the compound in case of trouble or during repairs.

Exhaust system . . . The engine exhaust manifolding (see accompanying photograph) is unitized into the power package skid unit and consists of a stack common to the four engines and four 8-in. exhaust lines which feed into the stack. This feature, plus the use of water jackets on the exhaust manifolds and lines as is required practice in California on drilling engines, makes for less danger of escaping well gases being ignited.

The bottom portion of the stack, up to the height of the engine exhaust manifolds, is divided into four compartments. Above that level it is a common unrestricted outlet for the exhaust gases from all engines. The stack is removable for legal moves over highways.

Provisions are included for maintaining a 2 to 3-in. water level in each 8-in. header, further cooling the exhaust before it enters the stack. Bellows-type expansion joints are used in exhaust lines. These prevent any severe strains being placed on the manifold system as a result of temperature changes.

Cooling of the power oil used in the torque converters is carried out in individual air-cooled radiators mounted directly above the torque converters. The fans which cool the oil radiators are driven through V-belts off the input shafts of the torque converter.

Mud circulation . . . Special thought was devoted to holding friction losses in the mud system to a minimum in order that maximum hydraulic horsepower would be available at the bit. To this end, 5½-in. drill casing is employed because, with its larger inside diameter, the pressure drop is approximately one-third of that through 4½-in. drill pipe. Also the drill casing weighs less than 4½-in. drill pipe; 15.5 lb. per foot as compared with 16.6 lb. for drill pipe.

As mentioned earlier, mud circulation is maintained by two 500-hp. power pumps, operated singly or in parallel. So that all available rig hydraulic horsepower will be utilized to circulate mud to the bit, and not be expended in mixing or conditioning mud in the pits, electric-motor-driven mixers are used. These include two mud agitators, one for each of the two 54-bbl. pits, and a "flash" mixer for the mud-mixing pit.

The mud manifold, as well as the derrick man's lab, is mounted over the suction pit. The pumps take suction through 10-in. lines and discharge into 4-in. lines. The pump manifold is so valved that the mud discharge can be directed to the standpipe, the kill line, the mud storage-tank line, or the bleeder line.

Ted Stoddard, Brea drilling superintendent; G. E. Pfenning, drilling engineer; N. D. McCollum, Brea drilling foreman, and Harold Radford, Brea district superintendent.

Fast-moving features . . . Several of the rig's quick-moving features are readily evident from the aforegoing description. All packages except the draw works and transmission are at rig grade level. Removal of a few bolts readies the two pumps for movement. Removal of the universal joints between the two power packages makes them available for moving.

The draw works is located on the subbase assembly, along with the driller's console which is located with but not included as part of the draw-works package. Little time thus is required for lifting or removing equipment onto the derrick floor. A step chain drive from the compound power takeoff to the jack-shaft drive assembly powers the draw works. This is the only chain drive which needs be broken for a rig move.

To simplify rigging up, locating devices have been installed on the various packages. Once the subbases are set, the mud-ditch unit, the engine package, and the compound transmission package are located with respect to the subbases. The mud pumps then are set with respect to the engine and compound packages, and the mud-pit unit is located with respect to the mud pumps. Setting equipment by measuring is eliminated, except for the subbases, since each package occupies the same position with respect to the hole and other packages at each well.

All possible equipment is unitized into the mast subbases and skid units. In the 12 by 8 by 42-ft. subbases are air compressors, air receivers, cellar pump, centrifugal water pumps, brake water-cooling tower, and electric panels. All possible lines likewise are unitized into the various packages.

Spreader beams are used to connect the two bases together, held by drive pins so that they can be quickly joined or dismantled. An accompanying photo shows how this planning has resulted in a clean, uncluttered working area around the well cellar. How the power package skids are tied to the bases is shown in another photo.

Piping between units is joined by unions and flexible lines to eliminate the need for repiping following rig moves. Where long lines are required they are grouped together for easy handling. Such is the case of the mud standpipe and kill lines, and the air and water lines. All are clamped to two 10-in. rig channels laid side by side. They break into two sections for moving.

All packages—subbases, power units, and pumps—are bottomed with steel bearing plates. Thus they can be placed directly on the ground without the necessity of placing mats or timbers.

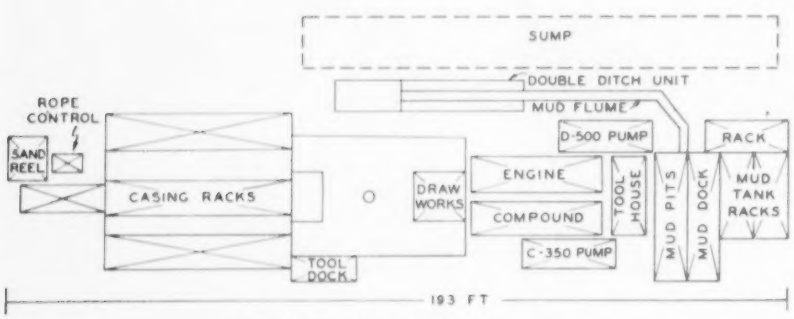
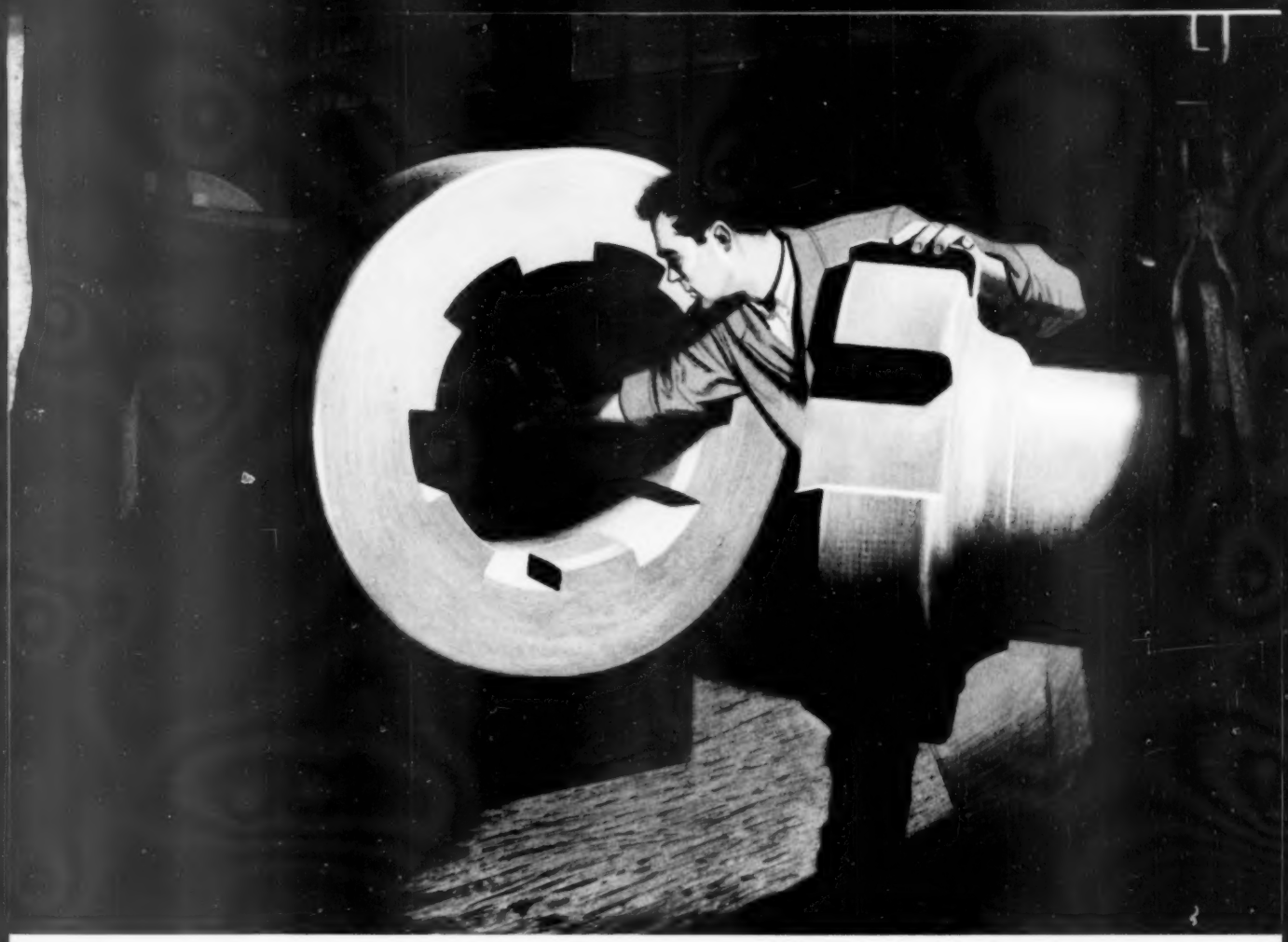


Fig. 1—Plan view of Shell's new rig.



It has to pass the torture chamber test!

The Spang Drill Pipe being loaded above into this "king-size" collapse chamber by a laboratory technician is about to undergo one of the toughest tests that Spang tubular products must pass while in the development stage.

In this test, a length of an experimental tubular product, which has been modified metallurgically by our research and development men, is locked within the cannon-like device—and its entire body subjected to high external hydrostatic pressures. In many such tests, pressures are taken up to 15,000 pounds per square inch.

To our engineers, the ability of a particular Spang development sample to withstand predetermined pressures without collapse measures its effective quality under stress. Hundreds of such tests are performed annually, covering not only collapse characteristics, but tension, torsional stress and fatigue resistance as well.

It is this "test every step of the way" that lies behind every Spang Tubular product introduced to the oil industry. More important, it is the continuous testing of this kind that assures you of *quality that you can depend on*—regardless of well conditions—when you specify Spang Tubular goods...or equipment bearing the National Blue Label.

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First in supply service
in oil country everywhere

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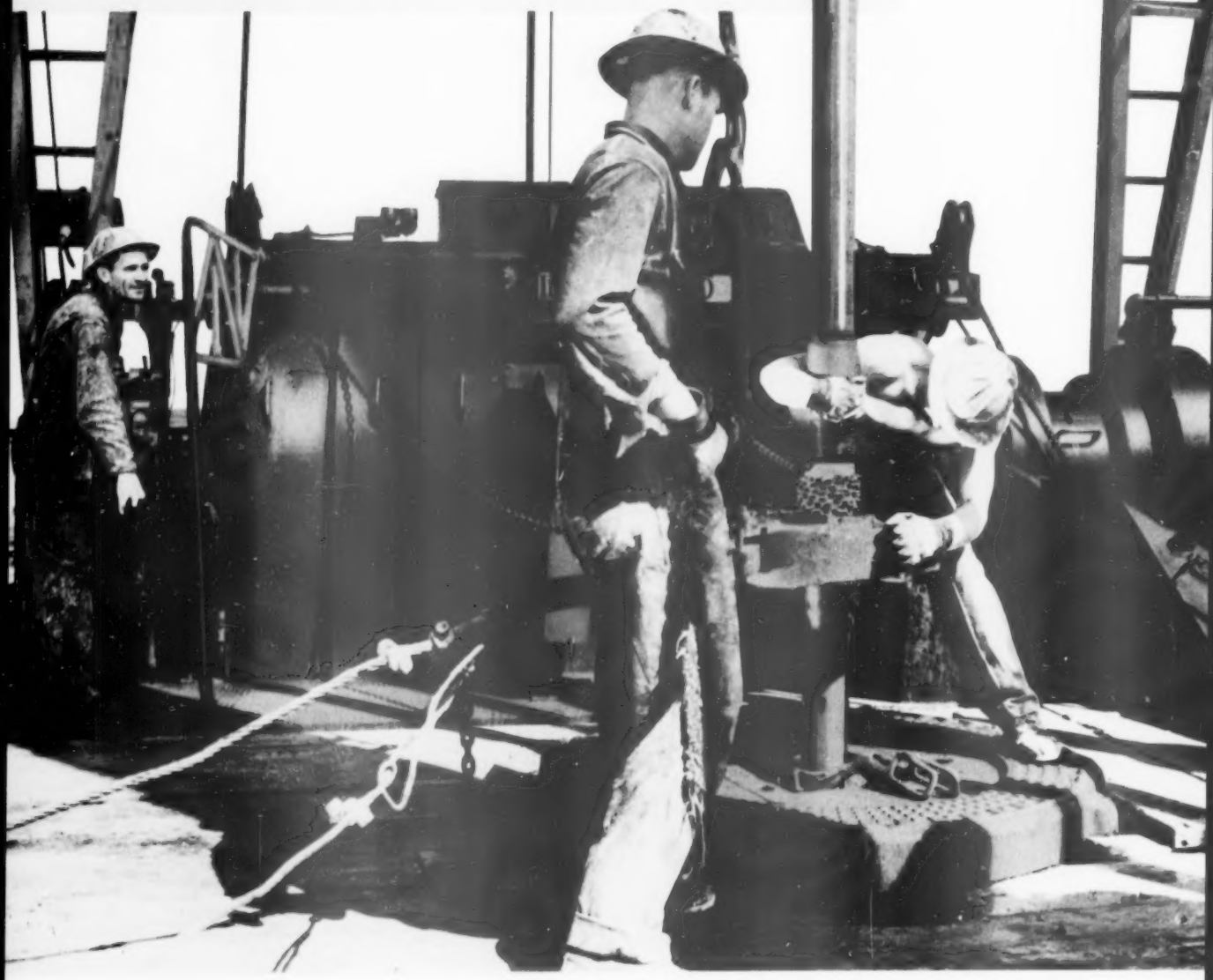
for quality that reduces operating costs,
specify **SPANGWELD DRILL PIPE** *and*
SPANG *Double Seal Shrink Thread* DRILL PIPE



From the kelly to the rock bit, these dependable Spang Tubular Products pay off in the well by reducing failures and costly downtime. Developed to withstand the stresses and pressures of modern drilling conditions, both Spangweld and Spang Double Seal Shrink Thread Drill Pipe are highly resistant to leakage, fatigue, tension and corrosion failures.

The reasons for this stamina are outstandingly evident in the tool joints of each. Streamlined Spangweld Drill Pipe has only ⅓ of the number of threaded elements found in conventional drill pipe and tool joints.

A precision metal-to-metal seal in the Spang Double Seal tool joint eliminates leakage and washout, prevents fluid entry into threads, and provides high resistance to creepage. Whenever necessary, Spang Double Seal tool joints can be rapidly replaced at the rig.

For highly abrasive service, both Spangweld and Spang Double Seal Shrink Thread tool joints are available with hard-facing. This feature is just another reason why oil men everywhere rely on these Spang products as the most dependable and economical that can be used.

Spang Double Seal Shrink Thread Drill Pipe & Tool Joints

- Quick and accurate engagement of threads in make-up
- Joints rapidly replaced at the rig
- Completely seals against internal and external pressures

Spangweld Drill Pipe

- Joints flash-welded to drill pipe
- Streamlined exterior contour
- Sizes for every drilling requirement
- Threaded elements reduced to ⅓ for faster handling

First in quality...
First in supply service
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NATIONAL BLUE PRODUCTS

CORROSION RESISTANT PLASTIC COATING AVAILABLE FOR SPANG DRILL PIPE

To increase corrosion resistance, a phenolic plastic coating can be applied at the mill on all Spang Drill Pipe and Tubing. Ask the National Supply Representative about this Spang service.

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for more information on another quality Spang Tubular Product,

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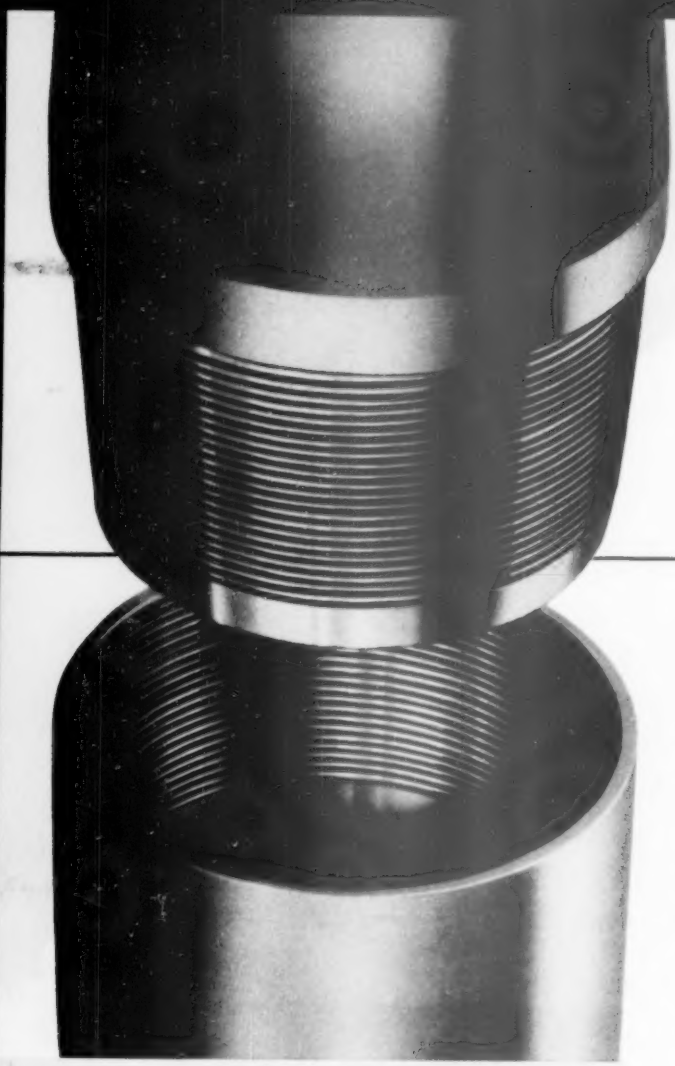

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GRADE J-55 – 55,000 PSI MINIMUM YIELD STRENGTH

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NATIONAL BLUE PRODUCTS

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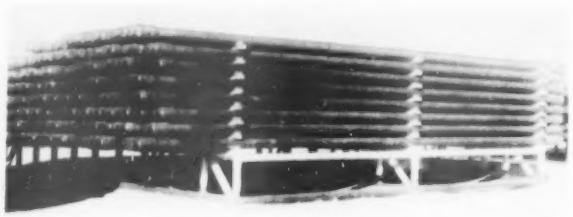
PRECISION-MANUFACTURED—Spang Casing has the mechanical and metallurgical properties to withstand the high tensile loading, and to resist the extreme pressures found in present-day deep drilling.

STREAMLINED—Interior and exterior contours provide for maximum running efficiency. There are no shoulders to hang-up on hole projections, or to scrape mud seal from the walls of the hole. Integral joint reduces the number of threaded connections by one-half.

EASY TO HANDLE—Very easy to stab, *cannot* be cross threaded, and positive shoulder contact engagement prevents overtonging. Only 5 to 7 turns with spinning line and less than one turn with the tongs are needed when running. Spang Extreme Line Casing can be salvaged and re-run repeatedly.

100% LEAK-RESISTANT—This positive resistance to leakage is of primary importance in the choice of high strength casing for deep, high pressure wells. The rugged integral joints of Spang Extreme Line Casing are your assurance of complete leakage resistance under the most severe and variable conditions you can encounter.



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THE NATIONAL SUPPLY COMPANY

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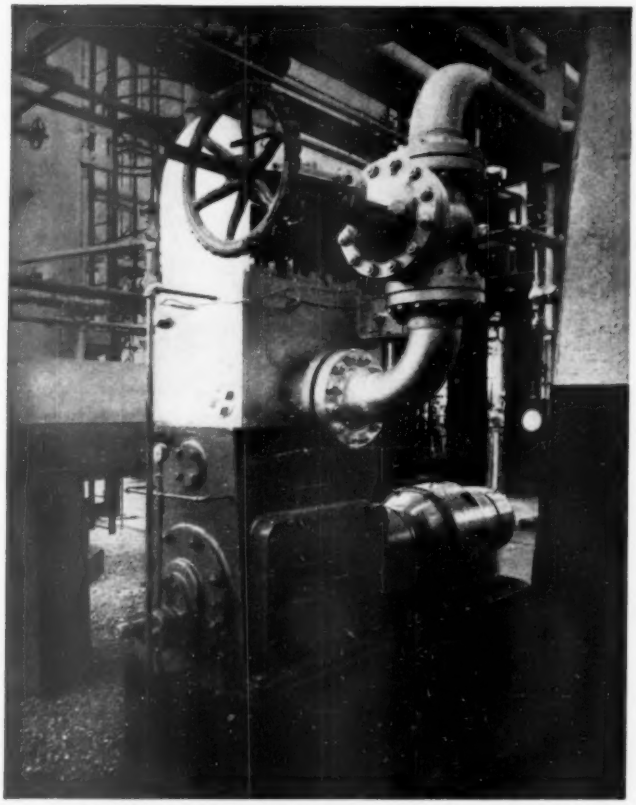
NATIONAL OIL FIELD MACHINERY AND EQUIPMENT

SPANG STEEL PIPE • SUPERIOR & ATLAS ENGINES



WORTHINGTON POWER PUMP handles light hydrocarbons at Indiana refinery. Close-clearance liquid end makes this pump a natural for handling propane, butane, and other volatile fluids.

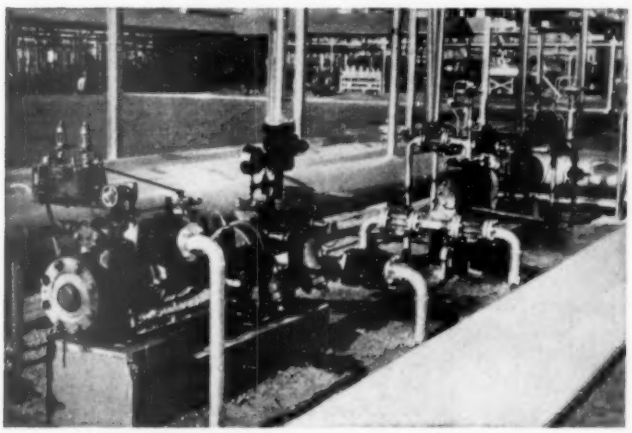
Power pump?
Steam pump?
Rotary pump?

You name it . . . we make it!

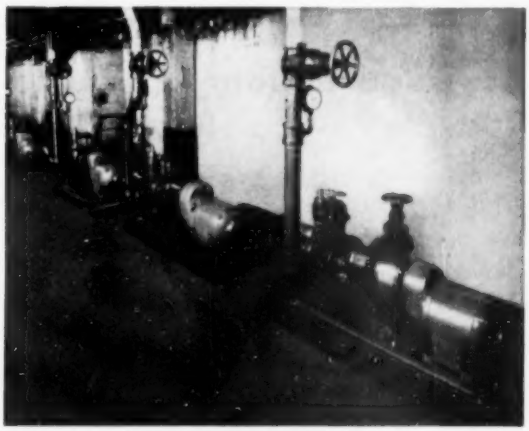
• When you're in the market for a pump, it stands to reason that you'll do better by going to a pump specialist. And that's exactly what Worthington has been since 1840.

Because we make all types of pumps—in thousands of different sizes—we're able to give an unbiased, objective opinion about any and all of your pump needs. No matter what your pressure requirements or type of power available, there's a Worthington pump that will suit your application exactly.

Write and tell us about your pumping problems. Be sure to give all pertinent details. Drop a line to your nearest Worthington district office or write directly to Worthington Corporation, Reciprocating Pump Division, Section P.3.2, Harrison, New Jersey. P.3.2



WORTHINGTON STEAM PUMPS pick up condensate from scrubbers for this petroleum company in Oklahoma. These units are part of Worthington's HiVol line—pumps specially designed to handle highly volatile liquids with high volumetric efficiency.



WORTHINGTON ROTARY PUMPS at this oil company plant in Pennsylvania are used for filling cans with motor oil of various viscosities. Every Worthington rotary pump is completely tested on oil before being put in stock.

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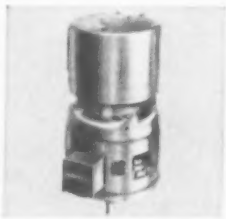
The Howell Brake Motor is designed for use in those applications where rapid stopping of rotation is required. Howell Brake Motors are used extensively on such machines as lathes, planers, drill presses and dumbwaiters.

Quick stoppage can be accomplished on motors of all types in most sizes. Brakes are of standard construction for long life and trouble-free operation.

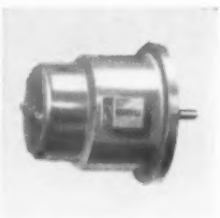
Howell Disc Brakes are integrally mounted, simple in design, easily accessible and quickly adjusted. For complete details on using Howell Brake Motors in your operation, contact the Howell man in your area, or write the factory for Bulletin BR-1 and further information.

Three types of Howell Brake Motors

Howell General Purpose, Dripproof, Horizontal Motor (Type SC) for wall mounting, with integrally-mounted disc brake.



Howell Vertical Face-Mounted Motor with 50 ft.-lb. brake. Howell Brake Motors fit a wide variety of applications.



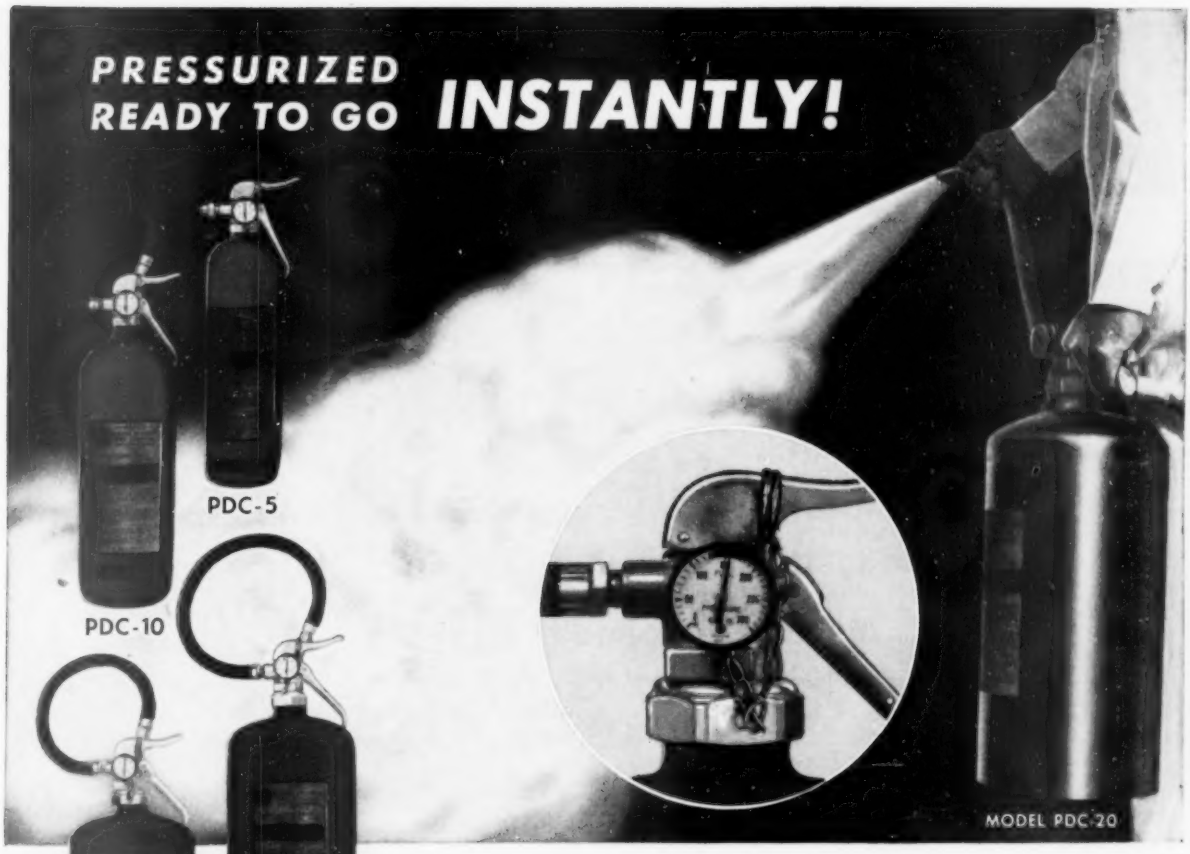
Howell Special Horizontal Flange-Mounted Pancake Motor with 3 ft.-lb. brake. This streamlined motor is unusually compact.

HOWELL Red Band MOTORS

HOWELL MOTORS

HOWELL ELECTRIC MOTORS COMPANY, HOWELL, MICHIGAN

PRECISION-BUILT MOTORS FOR INDUSTRY SINCE 1915



AMERICAN-LA FRANCE NEW DRY CHEMICAL FIRE EXTINGUISHERS

When fire hits, these new American-LaFrance Dry Chemical models are ready to stop it. Simply pull pin and squeeze lever. No gadgets to operate, no last minute pressurizing from a gas cartridge or cylinder, no inverting, no bumping, no shut-off nozzle on the hose needed. They're ready to go!

Their fire-smothering efficiency is aided by a scientifically designed Discharge Nozzle which fans the Dry Chemical downward in wide pattern and with great density. Their 150 (plus 25 minus 0) psi. air (or nitrogen) pressure maintains uniform duration of the Dry Chemical discharge pattern.

A glance at valve gauge indicates whether unit is in operating order. When partially operated, the extinguisher can be left standing without loss of air pressure, for use on a possible reflash.

The American-LaFrance Dry Chemical Valve is completely new also. It is ruggedly built. No special tools needed. Contains few parts. Equipped with Safety Relief Valve. Complete valve and siphon tube assembly removes as a single unit for recharging. They're water-tight, and noncorrosive. Tested for vibration and for operation at temperatures from minus 40° F. to plus 150° F. A Moisture Trap provides for pressurizing with air. Write for free illustrated literature.

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IN CANADA, LAFRANCE FIRE ENGINE & FOAMITE LTD., TORONTO

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INCORPORATED

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- for fluorescent colors and blooming agents used with additive compounded, solvent extracted lube oils
- dyes for gasolines, greases, waxes and industrial products
- for aviation gasoline, Petrol Ero blue

This material meets Mil-F-5572 Specification

"PETROL" COLORS
for gasoline, kerosene, diesel and tractor fuels . . . Bronzes, Ambers, Blues, Greens, Golds, Yellows, Purples, Oranges, Reds, Browns, Blacks.

GREASOL COLORS, for greases

STEARO COLORS, for waxes

SPECIAL PRODUCTS . . .

FUEL OIL ADDITIVE ELIMINATES FILTER-SCREEN CLOGGING
Mulsor for improved soluble oils for agriculture sprays

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PETROL BLUE WHITENER R AND B
are used to neutralize undesirable yellow shades in uncolored gasoline or kerosene.

DEBLOOMING AGENT A
has the property of neutralizing blooms in lubricating oils.

N. P. A. COLOR
has the property of changing body color of pale oils to red cast, without affecting natural fluorescence.

GASOLINE ADDITIVES
. . . inhibitors for gasoline, oil, rust . . . high pressure lubricants, stabilizers, emulsifiers, detergents, wetting agents, dispersing agents.

BODY COLOR #1
yellow brown cast for converting pale oils to reds.

BODY COLOR #302
red brown cast for converting pale oils to reds.

In addition to an extensive line of dyes, fluorescent colors, additives, blooming agents, etc., the technical staff of The Patent Chemical Company specializes in petroleum problems and is available for the study and preparation of particular products to meet special requirements involving dyes; fluorescent colors; additives; blooming, wetting, dispersion agents, etc.

for complete details write or phone

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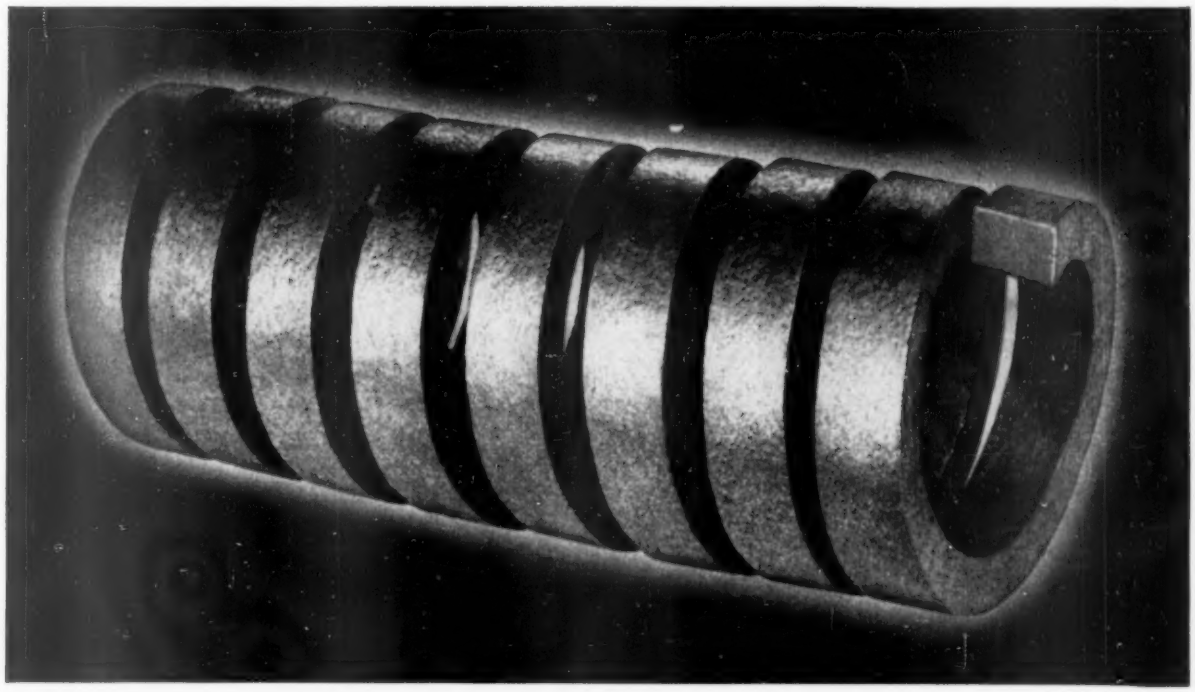
pioneers in gasoline colors • petroleum additives

For sealing oil and solvent pumps you can not beat R/M "versi-pak"®



R/M "versi-pak"—known by number as R/M 1845—is engineered so precisely to your oil and solvent pump requirements that it permits you to practice preventive rather than corrective maintenance. Its lubricants, ground in during manufacture, are so securely locked within the compound that even after wear sets in, the effectiveness of the bearing surface remains unchanged. An unusually uniform dispersion of long asbestos fibers throughout the binder gives it a completely homogeneous construction and, therefore, tremendous stability under pressure. And because no organic materials are included—only the cleanest, softest, most open asbestos fibers obtainable—it has exceptionally high resistance to heat.

R/M "versi-pak" is recommended for all centrifugal oil and solvent pumps operating at a maximum of 350°F and 600 psi. With it you can count on fewer adjustments, less downtime, lower maintenance costs, and longer equipment life. For complete information, write today.

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PACKING DIVISION, MANHEIM, PA.

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Take a trip with a MATHIESON *Technical Service Man*

This man, typical of the Mathieson Technical Service Staff, is experienced on an industry-wide basis in the handling and use of industrial chemicals. Every day, as a trip with a Mathieson Technical Service Man would show, brings up new problems on which his broad experience is invaluable. For example:

A paper mill in New England is visited and advised on super-bleaching with chlorine dioxide. A soap manufacturer in the Middle West wishes to discuss the advantages of low-iron caustic. A chemical plant in the East is counseled on the storage and handling of sulphuric acid. Several Southern textile mills are visited in connection with the storage of soda ash. A gray-iron foundry in Ohio is advised on controlling sulphur with Purite. A glass plant in the Southeast wants information on soda ash and nitrate of soda. A petroleum refinery in the Southwest seeks assistance on the handling of caustic soda, and several water works are advised on taste and odor control with chlorine dioxide.

And so it goes. More and more, industry is looking to Mathieson Technical Service for practical assistance on the handling and use of basic chemical raw materials. A call to your Mathieson representative is all that's needed to avail yourself of this industry-wide experience.

MATHIESON

MATHIESON CHEMICAL CORPORATION
Mathieson Industrial Chemicals Division
Baltimore 3, Maryland

2022

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dry ice and carbonic gas • ammonia • sodium nitrate • nitric acid
hydrazine products • sodium methylate • sodium chlorite • hypochlorite
products • sulphuric acid • ethylene glycols and oxide • methanol

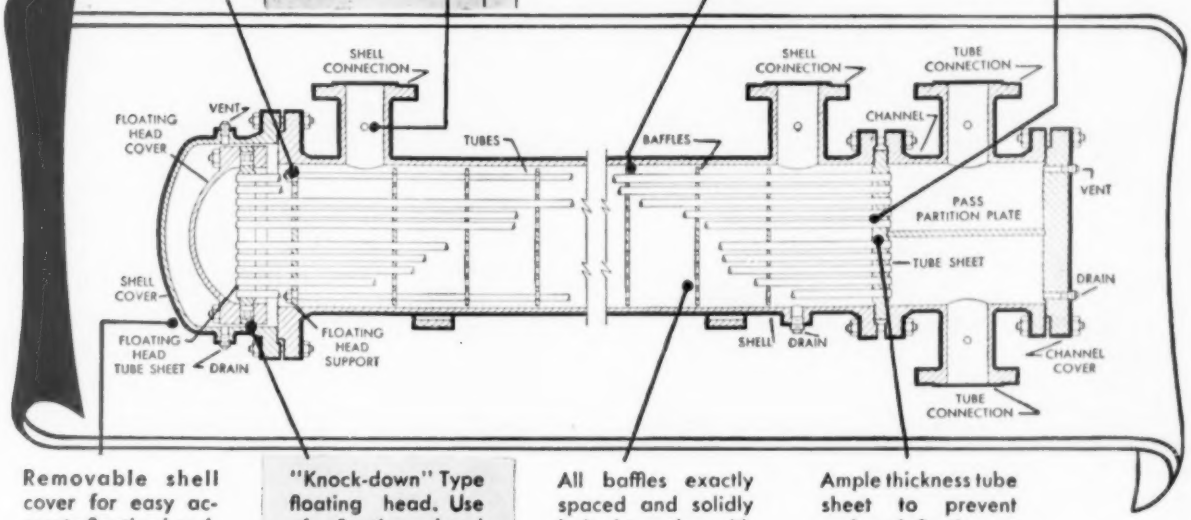
HEAT EXCHANGER EFFICIENCY starts with SUPERIOR DESIGN

"Do-Nut" shape support plate offers maximum support to the floating head without undue strain on the tubes, and tube surface loss.

Connection for pressure gauge and thermometer provided on all flanged connections.

Baffles — cross flow segmental type machine cut and drilled. Close tolerances assure maximum heat transfer.

Tubes — expanded into tube sheets by means of electronic controlled roller expanders, tubes cannot be over expanded or work hardened.



Removable shell cover for easy access to floating head.

"Knock-down" Type floating head. Use of floating head minimizes thermal expansion strains.

All baffles exactly spaced and solidly bolted together with heavy tie rods and spacers.

Ample thickness tube sheet to prevent undue deflection at pass partition plate.

The features of design which make a heat exchanger *good* are the features which contribute most to efficient, long-lived, trouble-free performance *under your operating conditions*. Since operating conditions are seldom exactly duplicated, industrial heat exchangers are usually custom-built . . . and design characteristics are different for each application.

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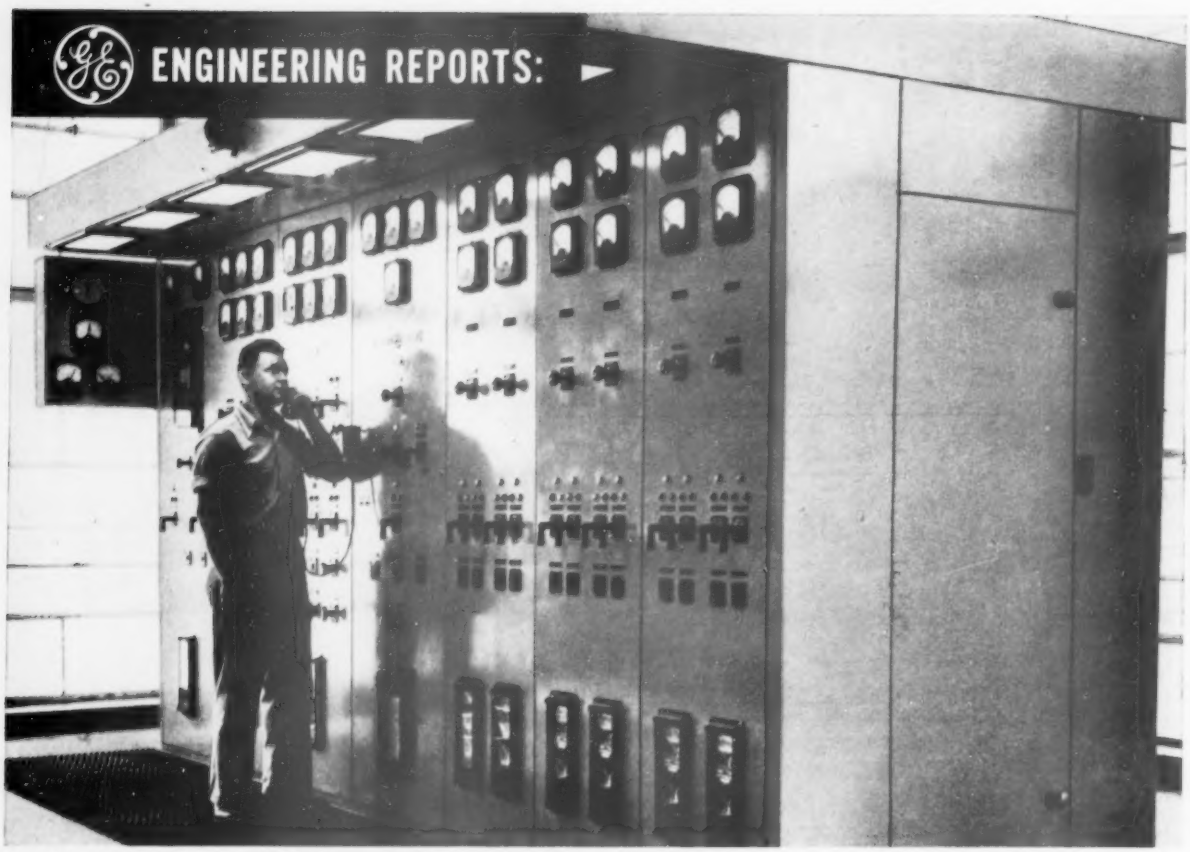
SUPERIOR HEAT EXCHANGERS

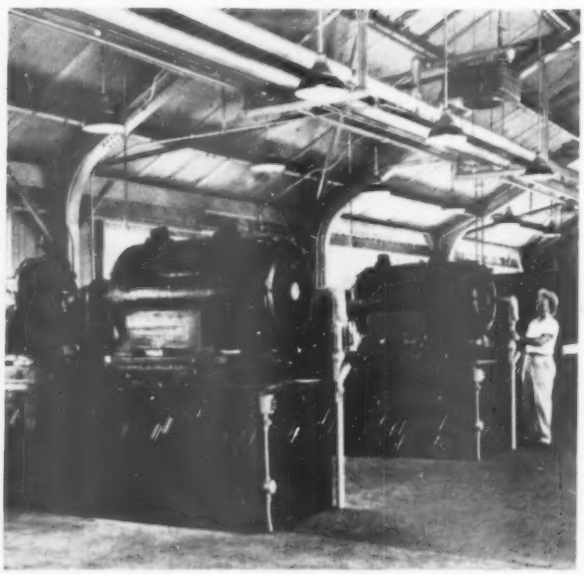
ENGINEERING REPORTS:



COMPACT, CENTRALIZED CONTROL PANEL handles high-voltage distribution economically for the entire Eagle Point Refinery operation. Incoming power from both plant generators is distributed to transformer banks, G-E limitamp control and switchgear. Interlocks assure safer operation, proper sequence. All enclosures are metal-clad for maximum protection.

G-E equipment helps Eagle Point

SIMPLE, FLEXIBLE DRIVE CONTROL for power station auxiliaries is provided by this G-E Limitamp panel. It protects motors for service pumps, raw water pumps, air supply apparatus.



FOR GREATER CONTINUOUS PROCESSING SAFETY, G-E motors at Eagle Point are totally enclosed, explosion-proof. Here, motors ranging from 200 to 400 hp drive transfer oil pumps.

ROUND-THE-CLOCK PRODUCTION at Eagle Point is aided by dependable G-E outdoor lighting. This modern plant-wide lighting system allows equipment to be moved quickly, safely. Critical operating areas are brightly lighted to step up efficiency of nighttime operating and maintenance work. Result: maximum output, night and day.

boost output 50% over rated capacity

20,000 barrels a day increase at Texaco's Westville, N.J. refinery aided by co-ordinated General Electric equipment

The Texas Company's Eagle Point Refinery in Westville, N. J. recently hit a production high when it boosted its output 50 per cent over rated capacity. General Electric equipment helped in this production increase—approximately 20,000 barrels of crude throughput a day.

Eagle Point is another of this country's top refineries to use co-ordinated G-E equipment and engineering services. G-E engineers, specializing in refinery applications, helped the Texas Company plan the electrical system, which includes provisions for future plant expansion. High-voltage distribution is one of the system's key features—power is transmitted to substations at 13,800 volts, reducing losses and improving voltage regulation.

If you are planning to build, expand, or modernize, let a team of G-E engineers help you design an electrical system for top production and flexibility. Contact your nearby G-E Apparatus Sales Office early—during the preliminary planning. General Electric Company, Schenectady 5, N. Y. 661-43

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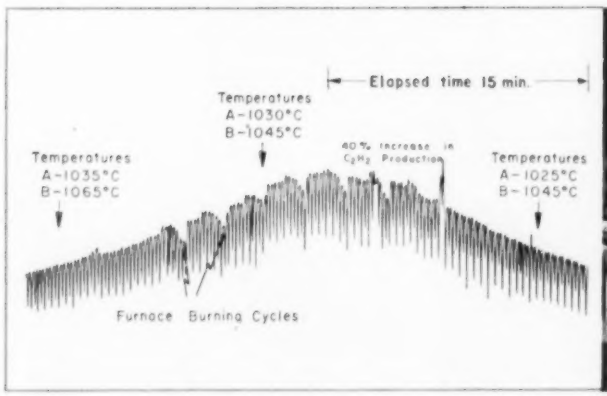
New acetylene production process uses the

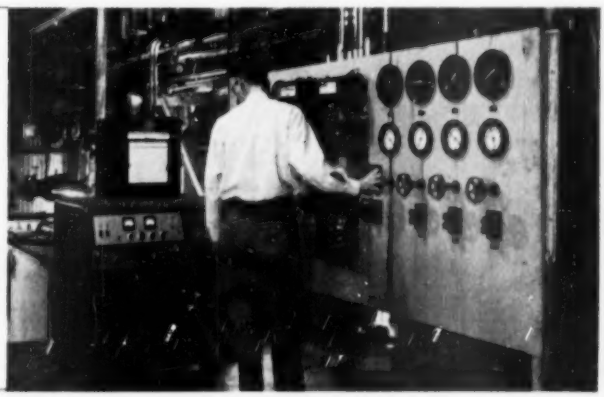
Consolidated continuous process–monitoring mass spectrometer.....

for "on the spot" control

The new Consolidated Model 21-610 continuous process monitoring mass spectrometer played a part in the development of the Wulff Process for the commercial production of acetylene. Requiring only 110 volts and a small quantity of cooling water for operation, this self-contained, completely portable instrument was placed on stream in the pilot plant, where it monitored various gas streams under a variety of imposed conditions. Samples from 19 different points, introduced through a common manifold for analysis, made possible among other things: (1) the monitoring of feed stock, (2) evaluation of cracking gas composition versus temperature, (3) determination of fuel gas composition, (4) measurement of acetylene or ethylene content in recycle gas, (5) diacetylene scrubber efficiency, (6) acetylene or ethylene absorber efficiency, (7) solvent recovery and/or loss, (8) final product purity.

The chart, below, left, illustrates the versatility and practical value of the Model 21-610 as a production control instrument. The mass-26 peak of acetylene was monitored in the cracking gas coming directly from the unit as the furnace temperature was varied. From right to left, the temperature was slowly increased. The rise in the cyclically scanned 26 peak indicates rising acetylene content of feed stock. This test showed that acetylene increased approximately 40% with a temperature rise of 5 degrees C. Using the chart as a reference, guesswork was eliminated and maximum future production assured. Write for Bulletin CEC-1824-X14.





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NEW CORADUR NOW ON ALL

"CORADUR" is good news for valve buyers. Created specifically to provide a better material for valve stems, this important new R-P&C metallurgical development gives valve users these important advantages:

1 • DURABILITY—LONG WEAR

Careful control of metallurgical components gives physical properties, such as low coefficient of friction, which reduce wear, prolong stem life.

2 • HIGH CORROSION RESISTANCE

3 • FREEDOM FROM DEZINCIFICATION

Chemical composition protects against this form of corrosion often experienced under brackish or adverse water conditions.

4 • HIGH TENSILE STRENGTH

Over 95,000 psi—25% more than ASTM or Federal specifications.

How Quality Control Protects R-P&C's Complete Valve Line

• At R-P&C a rigorous quality control program governs every step of the manufacturing operation—insures that each R-P&C valve conforms precisely to the close tolerances established for it. Precision inspection techniques check manufacturing operations and verify material soundness to insure that the trouble-free operation and long life engineered into each R-P&C design are delivered to the valve buyer.

Modern technological developments verify exactness of manufacturing operations. All bronze, iron and steel castings for R-P&C valves are made in the R-P&C foundry under careful metallurgical controls. Radiographic techniques using radium or radioactive isotopes, verify casting soundness.

A variety of gauging methods, including some developed by R-P&C engineers, verifies dimensional accuracy of all valve parts.

Performance of each individual valve is verified by hydrostatic and other tests before it leaves the factory. These tests are normally conducted at pressures in excess of those for which the valve is rated.

ASBESTOS-PACKED COCKS, an R-P&C exclusive, are furnished in iron in sizes from ¼" to 6" with screwed or flanged ends.

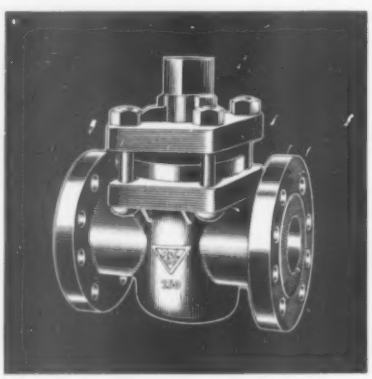
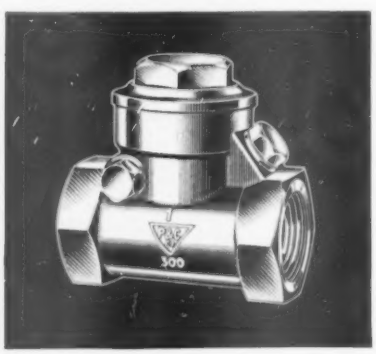


FIG. 212 SCREWED END BRONZE CHECK VALVE typifies R-P&C's complete check valve line—furnished in iron, bronze or cast steel in sizes ranging from ¼" to 24".



STEMS
R-P&C BRONZE VALVES

• Stems for all R-P&C bronze globe, angle and gate valves are now machined from cold drawn, stress relieved rods of this new aluminum-silicon bronze alloy. For example, at the left is a CORADUR stem on a **Fig. 706** rising stem gate valve, which is typical of R-P&C's complete bronze valve line. Rated for 200 pounds at 500° F, this valve is provided in sizes from ¼" to 3". Each of these valves is hydrostatically tested at a pressure of 600 pounds before leaving the factory.

Fig. 706, like all valves in R-P&C's complete line, is packed with construction features which reduce maintenance and insure long life. For example:

Nickel Alloy Wedges

Slip-on type has perfect symmetry of faces, making wedges reversible. Milled grooves on sides engage guide ribs in body, reducing wear on seats.

Wedges are entirely removed from line of flow when valve is fully opened. This reduces vibration thus eliminating a principal cause of valve wear.

Seats, integral with body, are made of ample width, to provide high wear resistance.

Packing • Valve design removes packing from high temperature zone, prolonging life. Positive backseat permits repacking under pressure when valve is full open. Formed rings of lubricated and graphited braided asbestos facilitate repacking, prolong packing life.

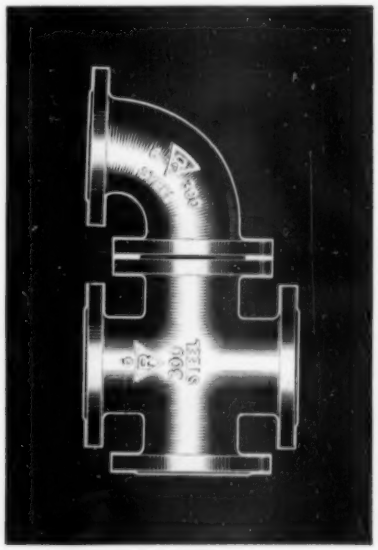
Union bonnet construction gives added strength to the valve and permits repeated removal of the bonnet without danger of distorting body or threads.

• • •

There is a valve to meet your every bronze valve requirement in R-P&C's complete line. Write today for your copy of catalog to R-P&C Valve Division, American Chain & Cable Company, Reading, Pa.

BAR STOCK VALVES are precision machined from highest quality bronze, carbon steel, or alloy steel bar stock. Working pressures range from 10,000 lbs. at 150°F to 475 lbs. at 1,000° F. Sizes from ⅛" to 1".

PRESSURE SEALED BONNET JOINT CAST STEEL VALVES are furnished in gate and globe valve styles in 900 lb., 1500 lb., and 2500 lb. pressure classes.



CAST STEEL FITTINGS, ells, tees, laterals, crossers, reducers—screwed or flanged ends. Furnished in sizes up to 24", in pressure classes from 150 lbs. to 2500 lbs.

***See** the complete* R-P&C *line at your distributors or write for catalog to* R-P&C *Valve Division, Reading, Pennsylvania*

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AMERICAN CHAIN & CABLE

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DEPENDABLE ...LOW COST

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IS ON THE JOB!

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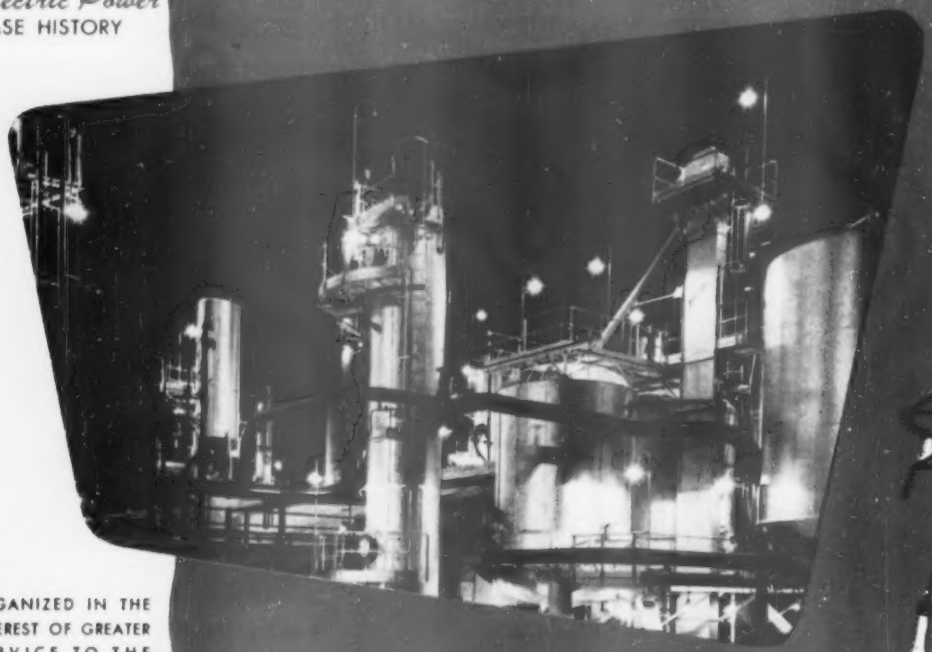
*PEP — Purchased Electric Power.

ANOTHER
Electric Power
CASE HISTORY



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PETROLEUM ELECTRIC POWER ASSOCIATION

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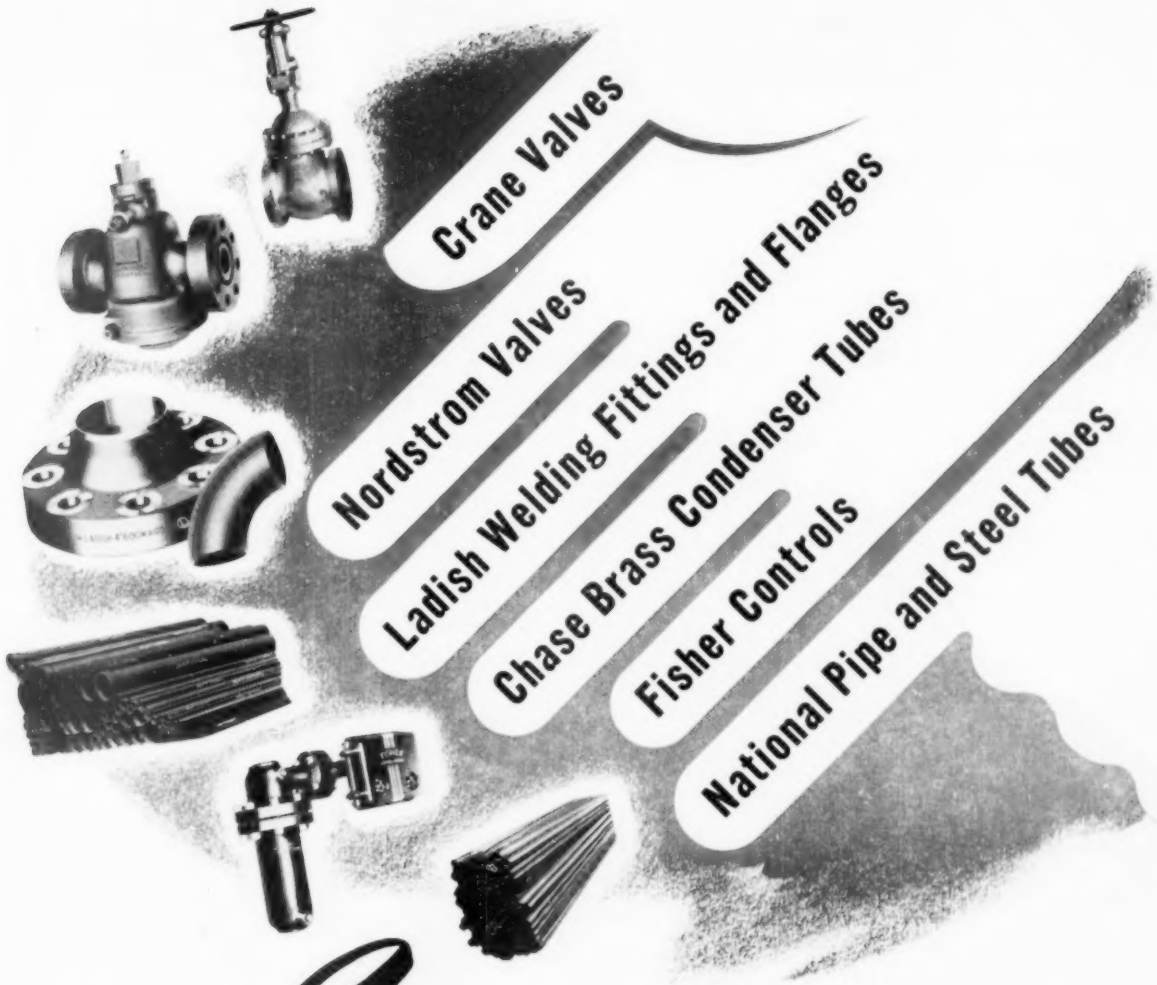

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And the Vinson Supply Company is your best source for these quality lines. Vinson's warehouses which carry complete stocks for quick delivery, are at points convenient to the needs of the Mid-Continent.

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measurement of percentage hydrogen in liquid hydrocarbons . . . . . .

Here is an instrument that utilizes the absorption of beta rays as a means of measuring the percentage of hydrogen, or the hydrogen-carbon ratio, in liquid hydrocarbons. Now . . . for the first time . . research men, product control engineers, and others can obtain a quick, accurate determination in five minutes instead of the four hours required by combustion train methods. Furthermore the measurement is made with an accuracy of 0.02 weight percent hydrogen as compared with the usual 0.05 weight percent hydrogen.

The new Cenco Beta Ray H/C Meter has numerous applications in petroleum processing . . . in refining operations where the hydrogen-carbon ratio is altered . . where the percentage of hydrogen is an index to the performance of end products, as fuel oils, jet fuels, gasolines, etc. Full details about this modern precision instrument are contained in our Bulletin No. 115. Write for your copy today. Exclusive manufacturing and sales rights for the Cenco Ray H/C Meter have been assigned to Central Scientific Company by Standard Oil Company (Indiana).

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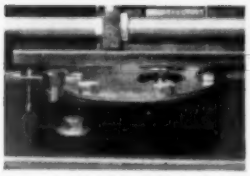
Your inquiry will be forwarded to the supplier within 48 hours (or less) from the time we receive it.

PROCESS CHANGES CAN'T OBSOLETE THIS TRANSMITTER . . .

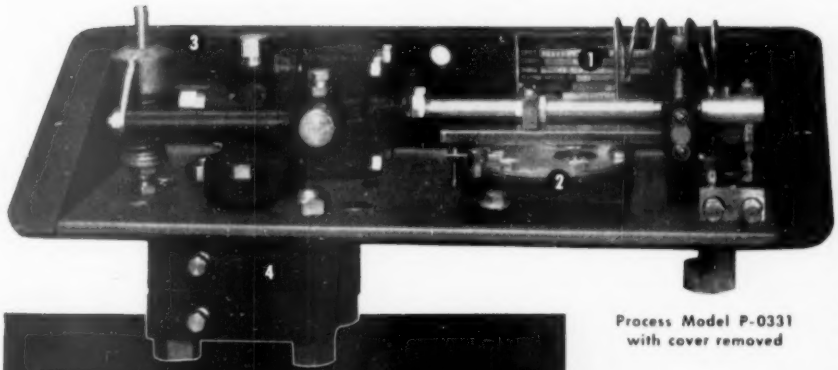
❶ 10-1 RANGE CHANGE —NO CHANGE OF PARTS

Double weighbeam construction on many models permits range changes as much as 10-1, just by turning a set of locking nuts to change a fulcrum point.

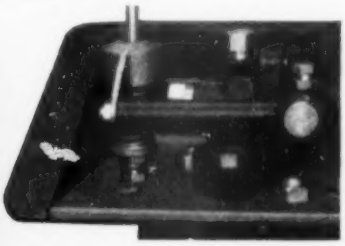


❷ ADDITIONAL 16-1 RANGE CHANGE—STILL NO PARTS CHANGE

Range may be changed on all models by loosening retaining bolts and sliding the reaction chamber to a new leverage position. Reaction area may be changed for further range change.



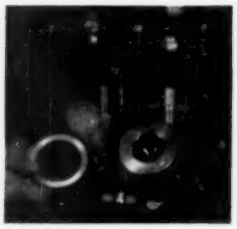
Process Model P-0331 with cover removed



❸ SUPPRESS, COMPOUND OR REVERSE RANGES

Balancing spring, installed to exert either an upward or downward force on transmitter weighbeam, quickly converts transmitter for range suppressions up to 80% of total range, for reversed ranges or for compound ranges where pressure fluctuates above and below atmospheric pressure.

REPUBLIC PNEUMATIC TRANSMITTER with EASY RANGE CHANGE



❹ MAJOR RANGE CHANGES

Range change plates may be easily inserted or removed from measuring chamber to change the effective diaphragm area for major range changes. Similar plates may be used also in the reaction chamber for further range change.

Here's the pneumatic transmitter for measuring differential, flow, pressure or level that saves you time and money when operating conditions are not definitely known or processes are likely to be changed. Extreme flexibility of design lets you adapt the same transmitter chassis for almost any range of measurements—often without any change of parts.

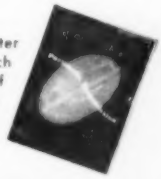
Process Model pictured above has a differential range of 0-12″ H_2O minimum and 0-880″ H_2O maximum at operating pressures to 1500 psig. Other models are available for differential ranges as low as 0-0.6 H_2O or as high as 0-750 psi.

Transmitters may be constructed of special materials to handle almost all types of corrosive fluids. Ruggedly built, they give long service, out-of-doors. Accuracy is guaranteed at ½% of full range on standard models.

Republic transmitters are used in process, chemical and petroleum plants all over the country. Investigate their advantages for your plant.

FREE DATA BOOK

Get the full story about Republic transmitter flexibility. Send for free Data Book which gives all the facts about complete line of Republic transmitters, including Square Root Extracting and Pneumatic Electric models.



REPUBLIC FLOW METERS CO.

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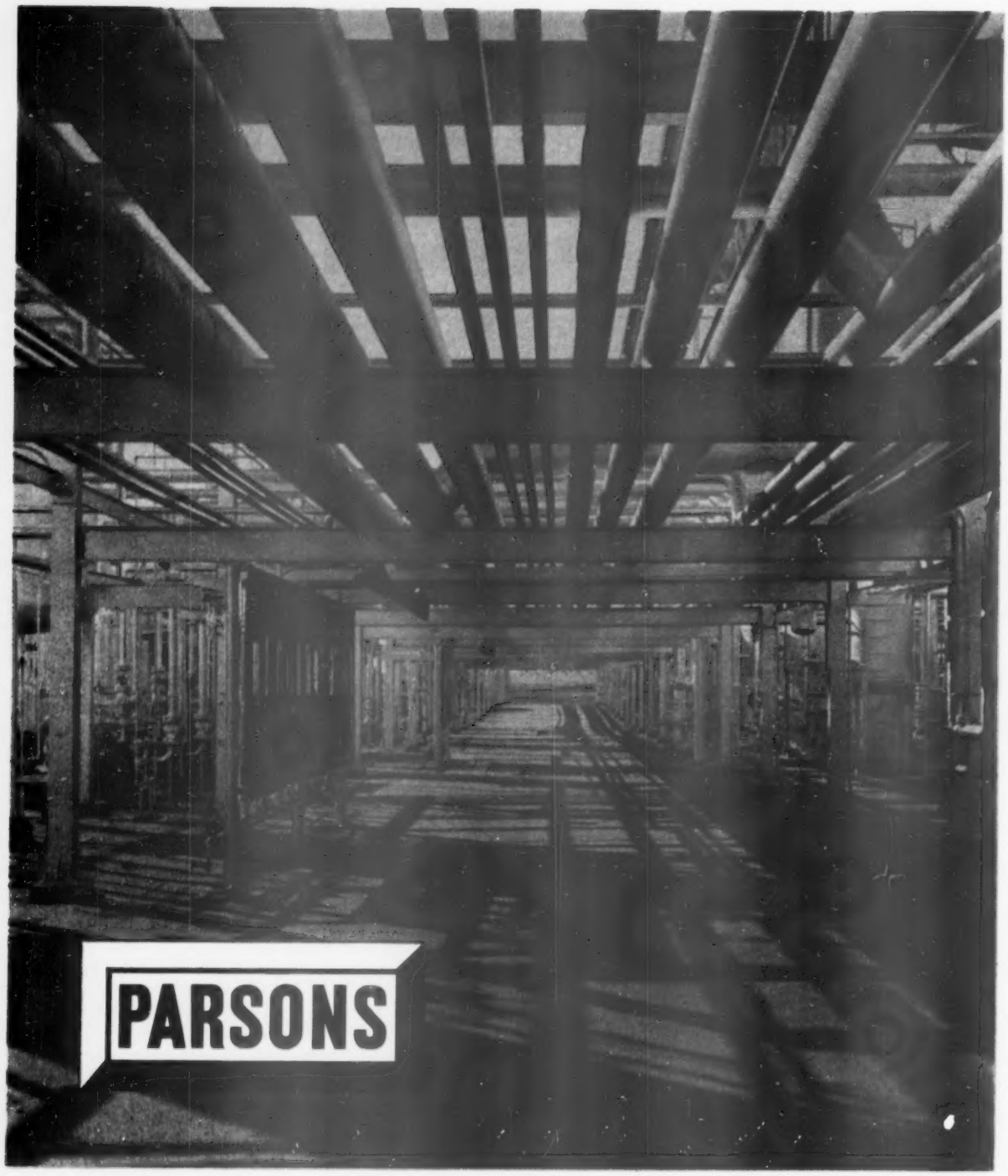
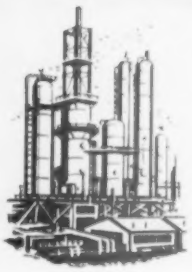


Serving the petroleum industry



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Refinery Engineers:
Here's Experience that SAVES YOUR TIME

Vacuum tower for crude distilling. Fabricated throughout by Posey Iron Works for one of America's largest refiners. 95'-5" high x 26' x 21' x 12' x 8' diameters.

You save time when you talk over refinery equipment problems with Posey Iron . . . because Posey Iron knows what you're talking about. Long experience in fabricating for the industry has taught Posey's engineers to understand loads . . . pressures . . . capacities . . . sectional construction . . . as encountered in *refineries*.

Posey Iron construction fully meets the ASME and API-ASME codes for unfired pressure vessels. Products are designed and built to comply with the requirements of the ASME; API-ASME and other codes. The Posey Iron Works is authorized to apply the appropriate code symbols.

Save your time. Talk to Posey Iron—first.

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DIVISIONS
Brick Machinery
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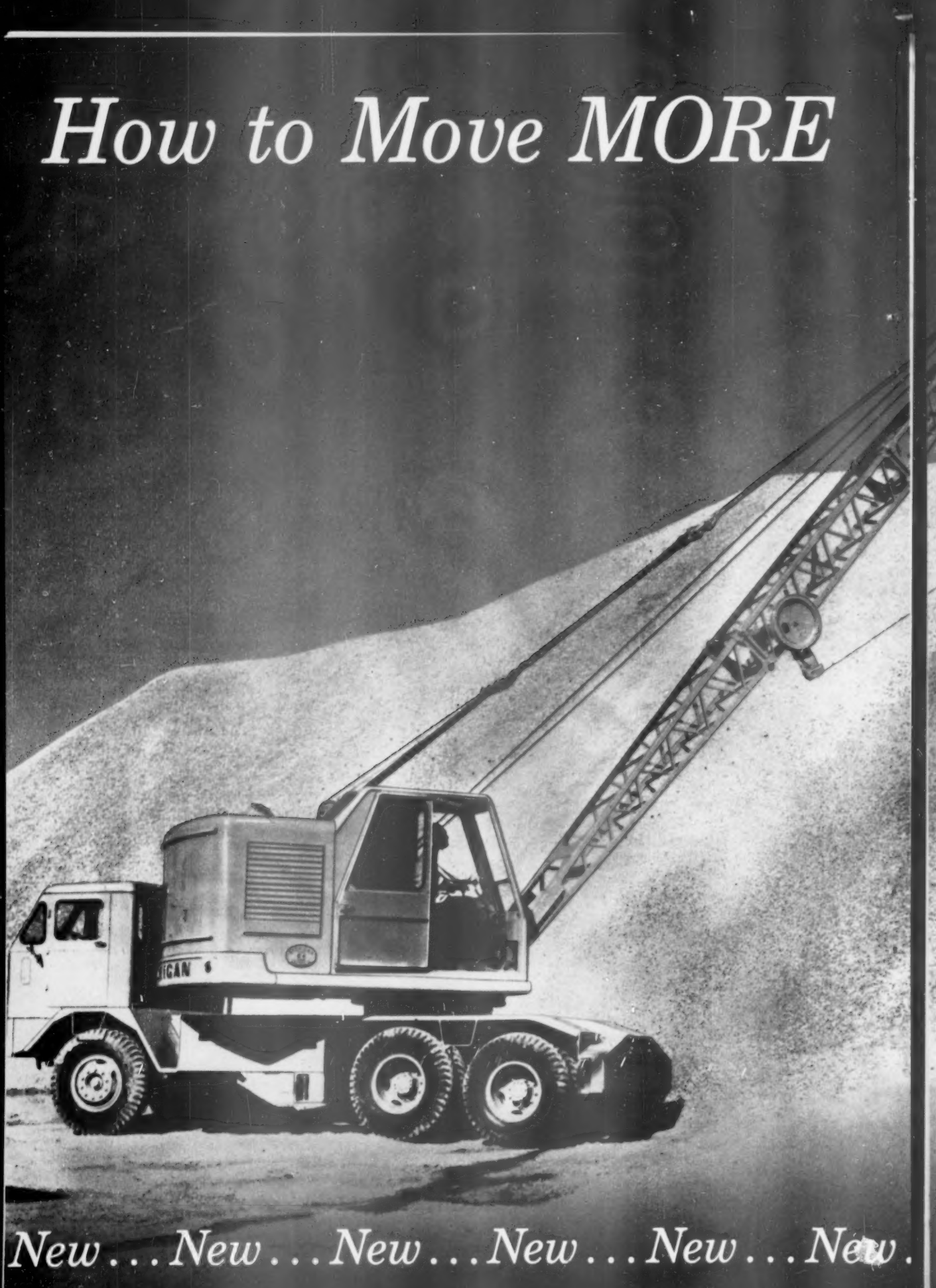
Steel Plate

How to Move MORE



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in 3/4 yard bites!

CLARK EQUIPMENT COMPANY
presents the

MICHIGAN Series "24"

Model T-24 Truck, 6 x 4 and 6 x 6; Model C-24 Crawler Shovel, Clamshell, Crane, Dragline, Hoe

14 Reasons Why — the MICHIGAN Series "24" Is Your Best Buy in '54

Full Vision Cab—new, stylized; all-around and overhead vision—3604 sq. in. glass; comfortable, quiet

Air Controls—clutches actuated by famous MICHIGAN* Air Controls

Power Clutches—single plate, double-disc, multiple-segment—air operated

Primary Drive—power transmitted through two sets spiral bevel gears running in oil

Shafts and Drums—hoist and crowd drums ball bearing-mounted on splined alloy steel anti-friction bearing-mounted shafts

Swing Brake — air operated; standard equipment

Circle Gear Casting—large diameter double-flange one-piece steel casting

Hook Rollers—six 7½" diameter, tapered, adjustable; ball-bearing mounted

Cast Turntable — machinery deck with boom hinge pin bracket and hook roller brackets—single steel casting

Big Brakes—powerful hoist and crowd brakes, 30" diameter

Worm Gear Boom Hoist—independent high speed hoist with automatic safety brake—standard

Removable Counterweight — power-handled for easy, quick removal or assembly

Truck Chassis—heavy duty; big engine, transmission, axles; deep section alloy steel frame, cross-braced, welded; rear and center outriggers standard

Crawler Base—one-piece cast steel carbody and circle gear; spring loaded safety brakes; 24" tracks standard

You'll find the MICHIGAN Fact-Folio handy and helpful; contains full specifications, an interesting book "Get More Yardage Through Air Power," and numerous action photos. The coupon will bring yours promptly.

*A Trademark of Clark Equipment Company

CLARK EQUIPMENT **Construction Machinery Division**

CLARK EQUIPMENT COMPANY
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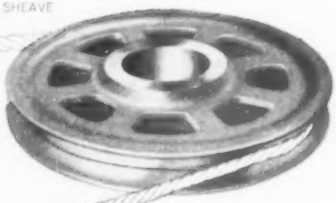
AMSCO

manganese steel sheaves extend wire rope life

OIL WELL SHEAVE

LADLE-CRANE HOIST SHEAVE



Wire rope replacements often cost more than the Amsco Sheaves that can minimize them.

Amsco Manganese Steel Sheaves work-harden under repeated impact and pressure, acquiring a polish that eliminates splintering. And because Manganese Steel Sheaves have high abrasion resistance they don't score.

Amsco Sheaves may be designed as single or double wall. The Double wall is particularly suited for applications involving extreme thrust.

BOOM POINT SHEAVE FOR POWER SHOVEL OR DRAGLINE

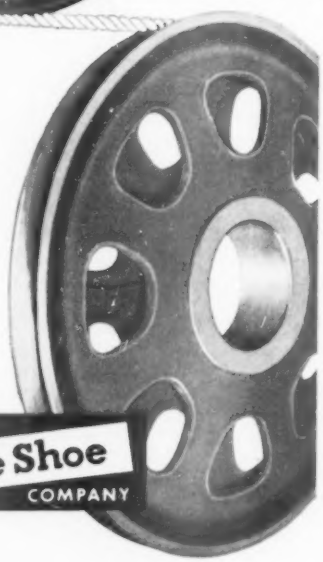
DOUBLE WALL SHEAVE

Cross section of an Amsco oil well sheave showing standard A.P.I. flange design.

Cross section of one type of Amsco Manganese Steel Sheave for industrial application.

Here is why Amsco Manganese Steel is called "the toughest steel known."

1. 12 to 14 percent Manganese
2. Work-hardens under impact to as high as 450-550 Brinell
3. Surface polishes to reduce wear, minimize need for lubrication
4. Strength and ductility for toughness
5. Readily weldable.



Write for your copy of the Amsco Catalog sheet for further details.

AMERICAN MANGANESE STEEL DIVISION

AMERICAN Brake Shoe COMPANY

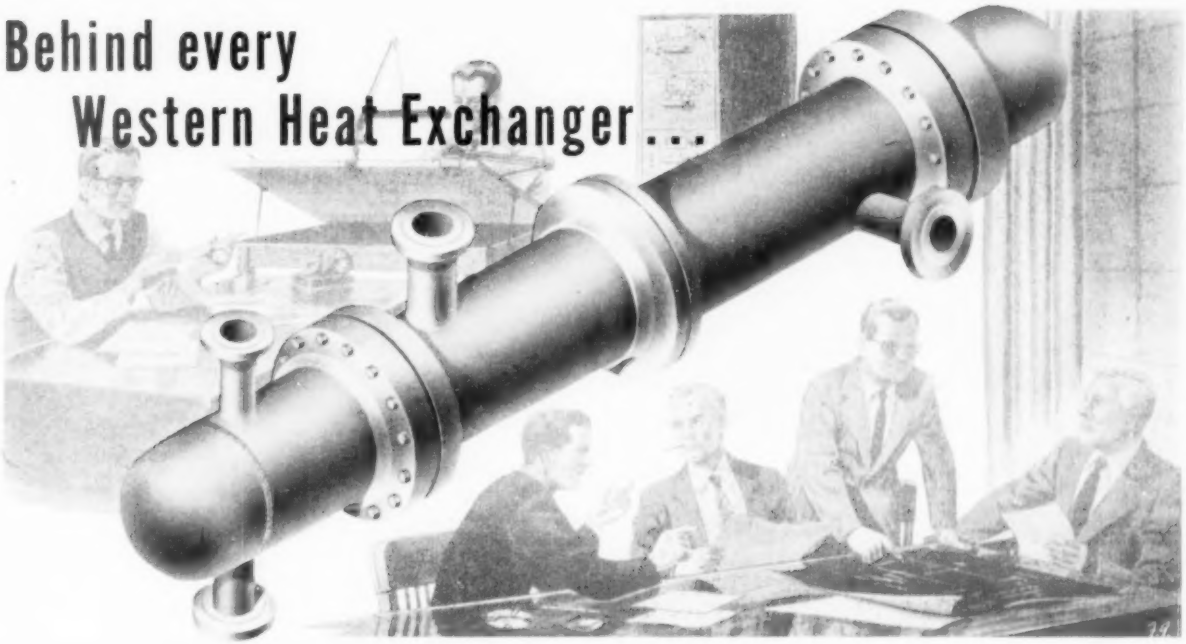
426 East 14th Street • Chicago Heights, Ill. OTHER PLANTS: NEW CASTLE, DEL., DENVER, OAKLAND, CAL., LOS ANGELES, ST. LOUIS. IN CANADA: JOLIETTE STEEL DIVISION, JOLIETTE, QUE. AMSCO WELDING PRODUCTS DISTRIBUTED IN CANADA BY CANADIAN LIQUID AIR CO., LTD.

"THE BRAND OF PROGRESS"

By Heat Exchanger Specialists

▲ SYNOPSIS OF AD NO. 3: Western Supply Company, designers and manufacturers of heat exchangers for the Petroleum, Chemical and Petrochemical industries, is daily pursuing its own research program in an effort to advance the technology of heat transfer. This research is carried on through Western equipment installed at the University of Tulsa and as a cooperative effort with the Tubular Exchanger Manufacturers Association which sponsors heat exchanger research at the University of Delaware.

Behind every Western Heat Exchanger...



A well known gas transmission company employed Western gas after-cooling equipment in their initial installation. As the gas demand and supply increased necessitating additional line capacity, varying ratios of compression were employed. Western engineers, collaborating with the transmission company, worked out section arrangements which minimized pressure drop during periods of high rate of flow yet provided adequate cooling during high compression ratio operation.

fourth in a new series of advertisements

Today's heat exchangers must answer exacting demands in widely varying temperature and pressure ranges. Standard and alloy metal fabrication is increasingly a matter of *custom design*, and the cost of heat exchangers has risen proportionately.

To hold exchanger pricing within reasonable and practical limits, Western Supply Company provides its customers with the services of an experienced staff of thermal and mechanical engineers . . . men who *know* heat transfer.

After studying specifications and consulting with the client, this group is charged with the responsibility of designing the exchanger to answer the need without superfluous material, labor or operational complications. In case after case this has meant savings to Western's customers.

The engineering staff stands behind every Western Heat Exchanger . . . *you* cash-in on this experience.

WESTERN HEAT EXCHANGERS

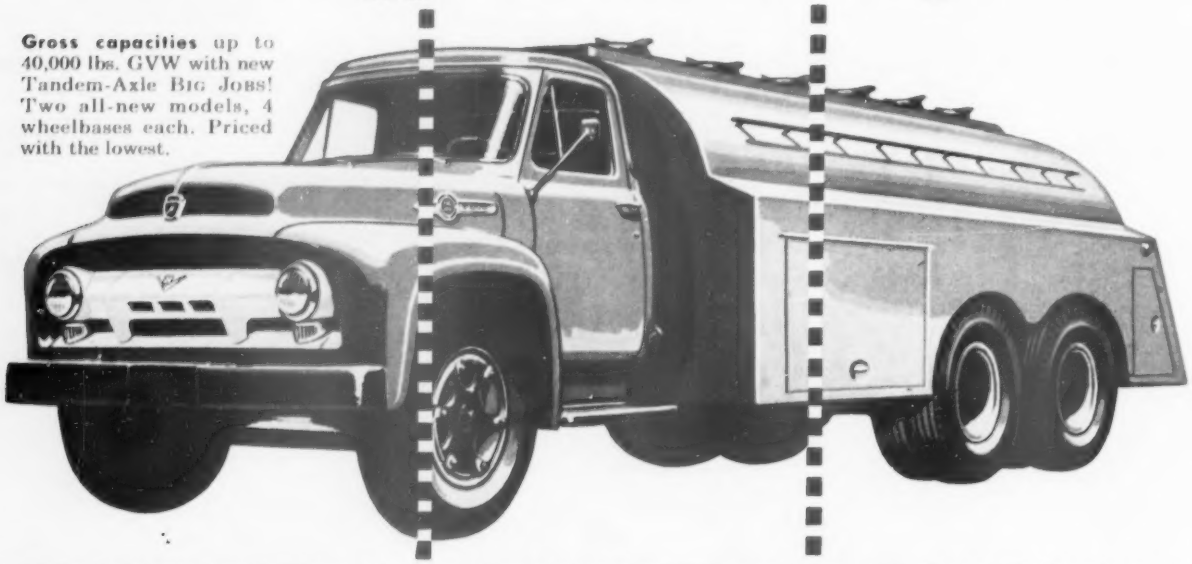
WESTERN SUPPLY CO.

P. O. BOX 1888 • TULSA, OKLAHOMA

TRIPLE ECONOMY

It's the biggest truck news of '54

Gross capacities up to 40,000 lbs. GVW with new Tandem-Axle BIG JOBS! Two all-new models, 4 wheelbases each. Priced with the lowest.



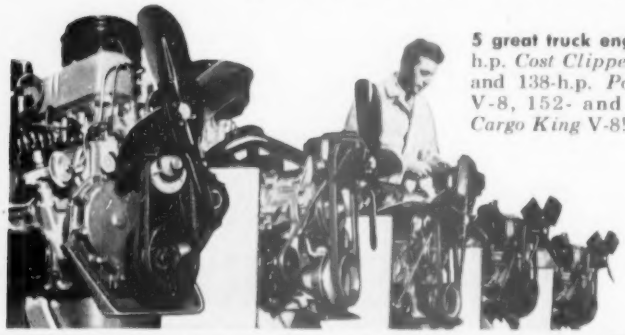
1. NEW LOW-FRICTION ENGINES offer power increases up to 23% with *gas-saving economy!* One reason: modern short-stroke design cuts down on internal friction waste as much as 33%!

2. NEW 3-MAN DRIVERIZED CABS cut fatigue. New long-wearing woven plastic seat upholstery. Exclusive Ford *seat shock snubbers!* Huge one-piece windshield!

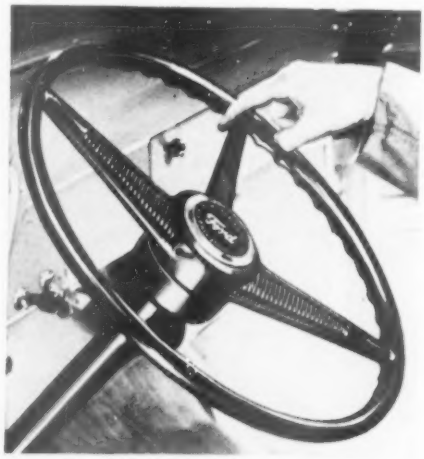
3. NEW CAPACITIES! New Factory-Built 6-Wheelers, up to 60,000 lbs. GCW! Two new Cab Forward BIG JOBS! Ford's 221 models offer low curb weights, top payloads!

Ford advances *further* with big new savings in all 3 vital truck areas! There's *more* gas-saving power! *Still better* drivers' working facilities! *Big* capacities, too!

New Ford Trucks for '54 offer the mightiest concentration of power per cubic inch ever built into *any* truck engine line! And, smaller-displacement engines like Ford's five new truck powerplants normally need *less* gas! That's only *one* big factor behind Ford Truck *Triple Economy* for 1954. For more information, write: Ford Division, Ford Motor Co., Dept. T-20, Box 658, Dearborn, Michigan—or call on your Ford Dealer, *today!*



5 great truck engines: 115-h.p. *Cost Clipper* Six, 130- and 138-h.p. *Power King* V-8, 152- and 170-h.p. *Cargo King* V-8!



NEW Ford Master-Guide Power Steering is standard on new Series T-800 and (with 152-h.p. V-8) T-700 BIG JOBS; optional at worthwhile extra cost on most other BIG JOBS. Cuts steering effort as much as 75%!

ONLY FORD gives you Gas-Saving, LOW-FRICTION, High-Compression, Overhead-Valve, Deep-Block engines in *all* truck models! Advancements like rotating valves increase valve life, and full-flow oil filter lengthens engine life.

FORD *TRIPLE ECONOMY* **TRUCKS**

MORE TRUCK FOR YOUR MONEY

For

maximum fuel savings →

better temperature control →

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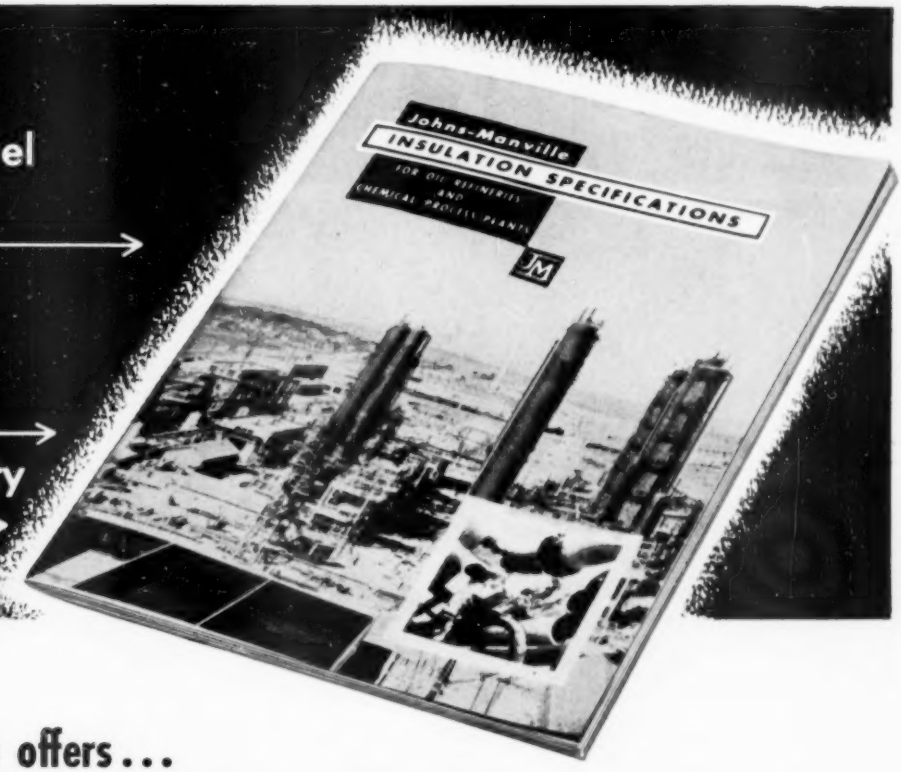

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new 52-page THERMAL INSULATION SPECIFICATIONS manual

For the oil refining and chemical process industries—the most complete manual of thermal insulation specifications ever offered! It contains 52 pages of data, specifies the correct insulations and methods of application for equipment in every temperature range encountered in these industries. Vessels, tanks, flues, pipes, breechings, stacks, vacuum filters, oil heaters and many other types of equipment are included.

Johns-Manville offers industry undivided responsibility for all thermal insulation requirements. J-M complete insulation service includes:

J-M Materials—for every temperature requirement from minus 400F to plus 3000F. The many different kinds and forms of J-M Insulations include pipe insulation, sheets, blocks, bricks, blankets, insulating cements and fills, insulating papers and felts.

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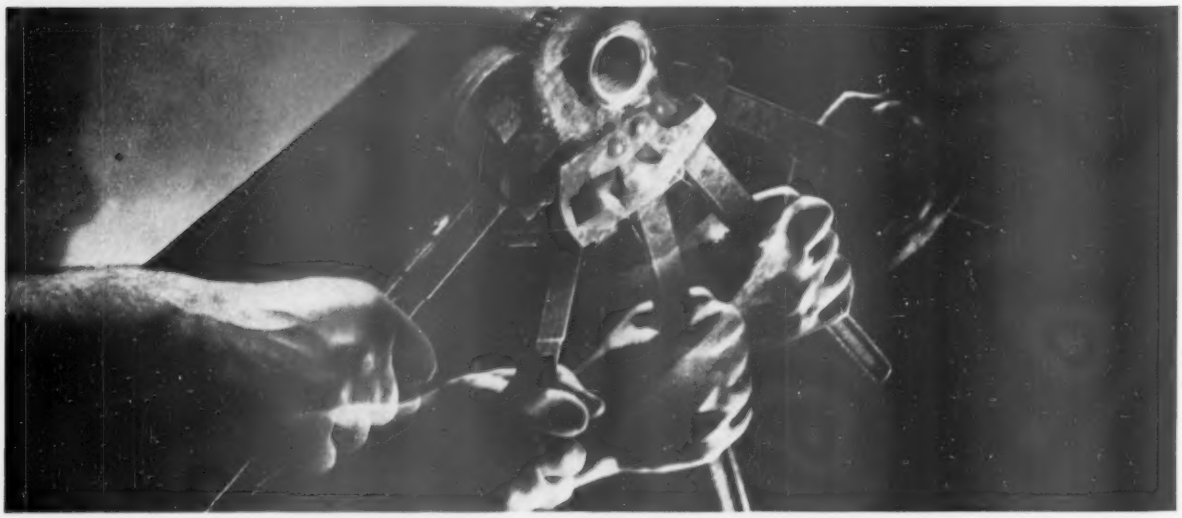

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"PIPE WITH THE YEARMARK"

STEEL PIPE

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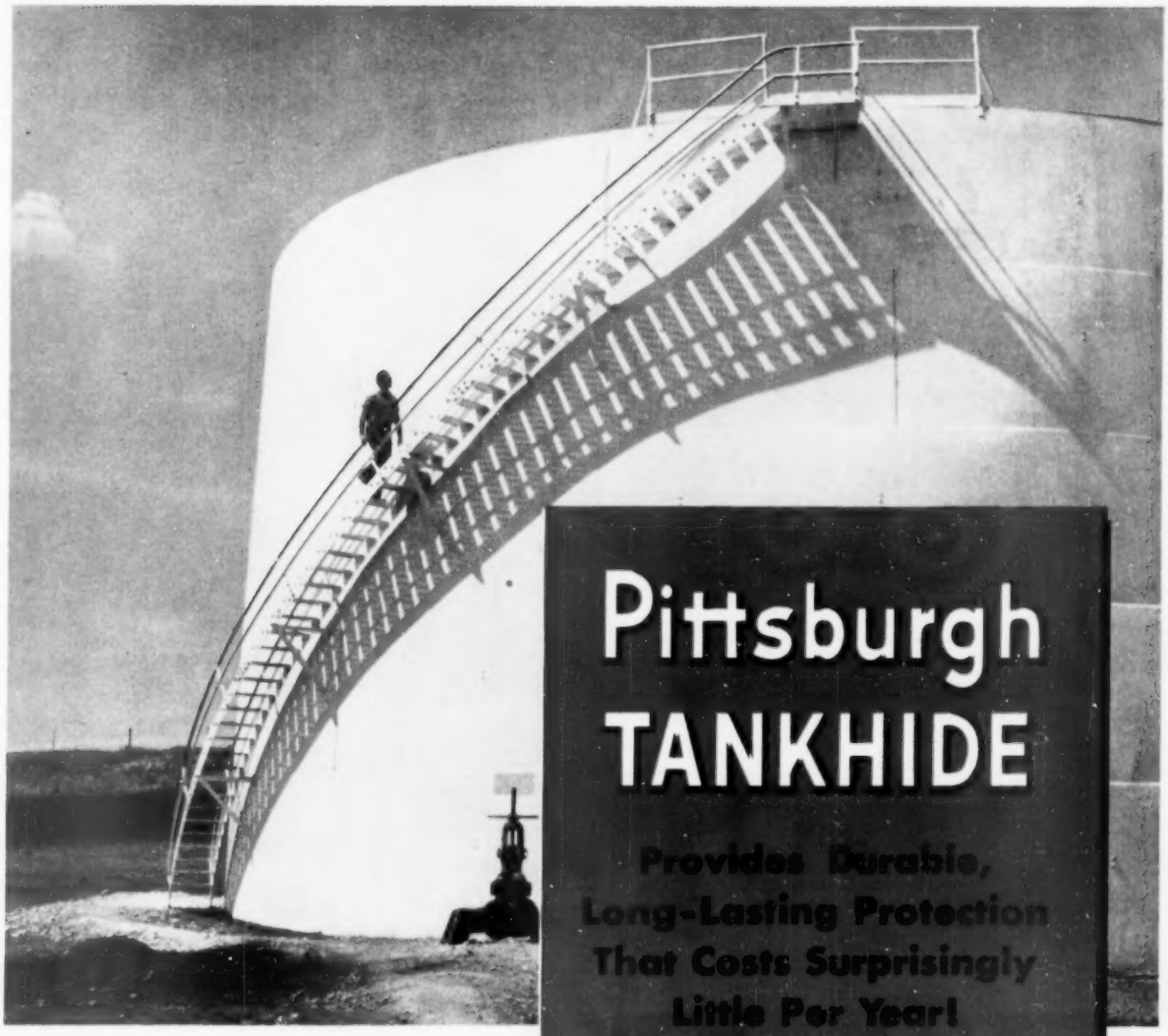

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Provides Durable, Long-Lasting Protection That Costs Surprisingly Little Per Year!

FOR DOWNRIGHT TOUGHNESS there's no other protective coating like Pittsburgh's TANKHIDE! It's a rugged, long-lasting finish, highly resistant to corrosion and the weather. It goes on easily, dries quickly and "stays put" for enduring protection.

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The brilliant white appearance of TANKHIDE is maintained throughout its long life by its self-cleaning action. The quick set and firm character of the film during the drying period prevent collection of dirt and insects . . . also keep damage from rain, scuffing and abrasion at a minimum.

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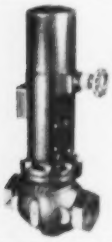
For reliable, automatic control of your product or process . . . whether it is in a heating, refrigeration, industrial or aircraft application . . . General Controls automatic controls will provide dependable, low cost, trouble free performance. Send for a copy of Catalog 53G . . . on your company letterhead, please.

B-55G Governor Type Gas Valve for on-off, high-low modulating and air damper control. Slow opening diaphragm. For gas-flow to industrial boilers and furnaces.



V-110 Electro-Magnetic Valve for gas- and oil-fired boilers. Electro-magnetic trip mechanism prevents flow until current is supplied. Positive safety shutoff.

K-21 Magnetic Stop Valve for liquid and gas. Humless. Coil variations for many temperature and flow requirements. Positive safety shut-off. Valve closes with flow.

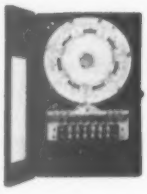
Hydramotor Valve. Screwed type valve body. Fast acting actuator; positive shut-off in ½ to 2 seconds. H-Series actuators available in speeds for every application.

Hydramotor. ac two-wire actuator with specially designed electro-hydraulic pump. Provides reliable normally-open or normally-closed service for gas or fluid control.

Air Motor Valve. Air-opening and closing diaphragm actuators. For modulating control with valve positioners, timers or other instruments for high accuracy flow control.

L-59T Refrigeration Temperature Control. Designed for industrial applications to control magnetic or motor-operated valves, heating or cooling units, relays, etc.

Electronic bridge, signalling type temperature controller. No batteries or moving parts. Excellent performance, high sensitivity with minimum maintenance.

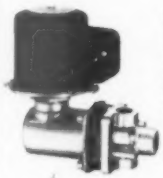


Program Timer, powered by electric or spring-wound clock. Controls daily or weekly operations. Maximum 12 operations a day; 18 minute "off" period.

Pneumatic Indicator in cast aluminum case. Assemblies interchangeable. One of General Controls' wide line of pneumatic indicators, recorders and controllers.

K-15 Magnetic Piloted Piston Valve for gas and liquid control. Large flow capacity, humless and fail-safe. Available in 3 coil, and 5 seat variations.

V-301 and V-302 Pneumatic Pressure Regulators are designed to reduce line pressures up to 150 psi to working pressures of 0-30, 0-60, or 0-100 psi.



K-13 Series 3-Way Packless Magnetic Valves. Solenoid operated, two-wire, current failure type. Designed to control fluids to piston and diaphragm operators.

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Glendale, California • Skokie, Illinois

Manufacturers of Automatic Pressure, Temperature, Level and Flow Controls for Heating, Home Appliances, Refrigeration, Industrial and Aircraft Applications.

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This Simple Compressor Meets the Complex Needs of a Changing Petroleum Industry

It's the Nash!

Here is a compressor presenting advantages found in no other device. Nash Compressors have only one moving part, rotating without metallic contact with the pump casing. No internal lubrication is required. Yet they produce 75 lbs. pressure in a single stage, with capacities to 6 million cu. ft. per day in a single structure.

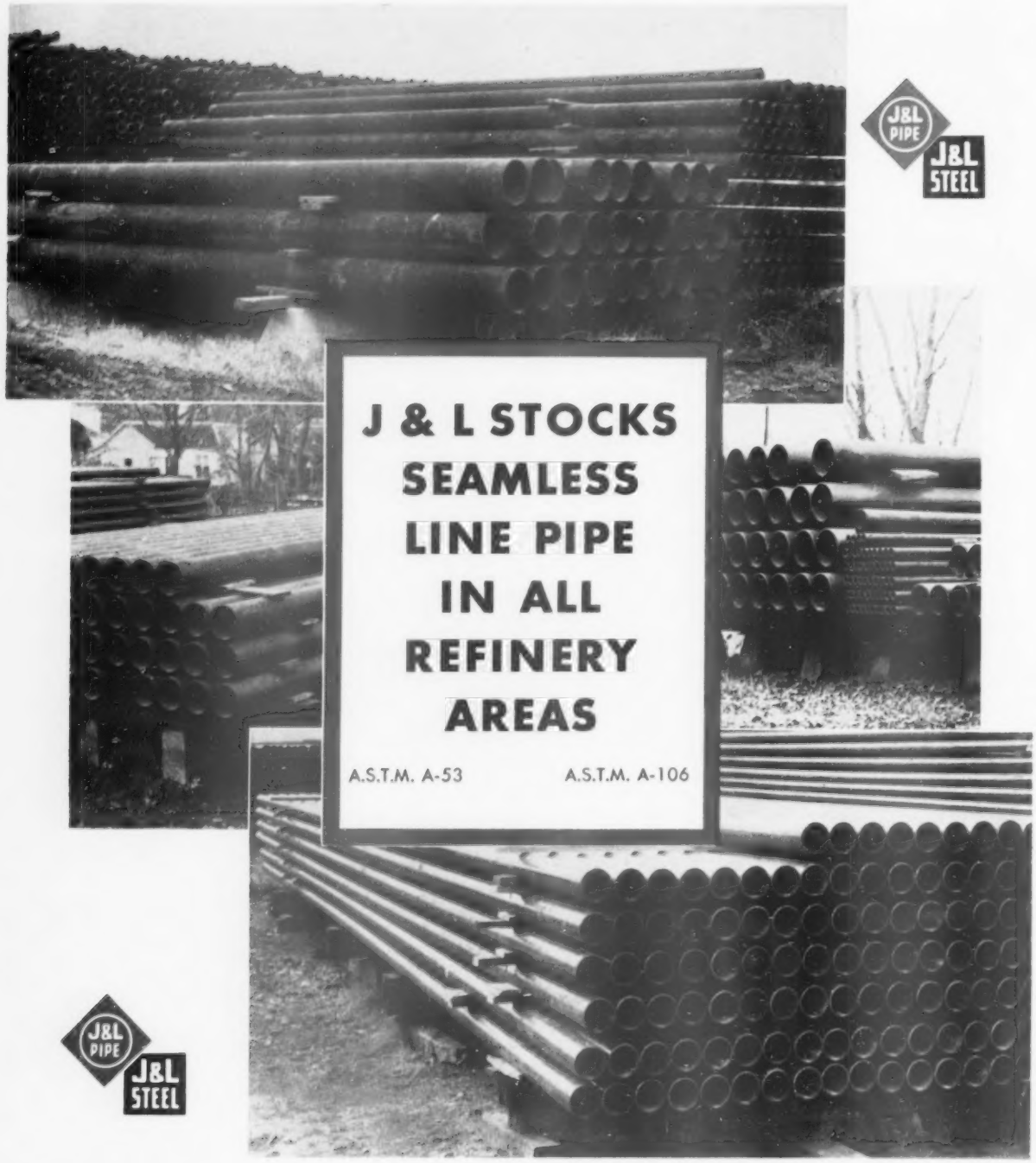
There are no valves, gears, pistons, sliding vanes, or other complicated wearing parts in a Nash. Compression is secured by an entirely different principle of operation. Because of this, gas pumping problems difficult with ordinary pumps are often easily handled by the Nash. For example, Nash Pumps are standard equipment in the Synthetic Rubber Industry, where they have met the needs of new and difficult processes.

Nash Compressors are compact and save space. They run without vibration, and compression is without pulsation. They maintain original performance over long periods. Service is assured by a nationwide net-work of Engineering Service offices. Instructive bulletin shows how they operate. Write for it.

- One moving part.
- No internal wearing parts.
- No valves, pistons, or sliding vanes.
- No internal lubrication.
- Low maintenance.
- Slugs of liquid entering pump do no harm.
- Non-pulsating pressure.
- Saves floor space.
- 75 pounds in a single stage.

NASH ENGINEERING COMPANY

274 WILSON, SO. NORWALK, CONN.



J&L STEEL

"...here's MY warehouse!"

JONES & LAUGHLIN STEEL CORPORATION
SUPPLY DIVISION

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PESA
PARTNERS IN PETROLEUM PROGRESS

As never before...

Today we are all aware of the disastrous and far-reaching effects of a major industrial fire. Owners . . . management . . . employees . . . customers . . . almost every one suffers, in one way or another, when a serious fire strikes.

Could it happen to your plant? Now is the time to take a long, close look at your plant's fire protection measures. Remember, the local fire protection ordinances normally only set minimum standards. Compliance with these ordinances is no guarantee of fully adequate firesafety.

One way to be absolutely sure of the efficiency of your plant's fire protection facilities is to call in an expert C-O-TWO Fire Protection Engineer. He is ready and willing to help you with any or all industrial fire hazard problems.

There is a personal sense of responsibility inherent with C-O-TWO Fire Protection Engineers that assures you of fully adequate firesafety . . . a definite plus in your behalf. Whether it's fire detecting or fire extinguishing . . . portables or built-in systems . . . C-O-TWO means top quality backed by experienced engineering that results in operating superiority for you at all times.

WHEN BUSINESS STOPS . . . INCOME STOPS!

Don't take chances with your investment. Secure the benefits of highly efficient fire protection engineering today . . . our extensive experience over the years is at your disposal without obligation. Get the facts now!

C-O-TWO

MANUFACTURERS OF APPROVED FIRE PROTECTION EQUIPMENT

Squeez-Grip Carbon Dioxide Type Fire Extinguishers
Dry Chemical Type Fire Extinguishers
Built-In High Pressure and Low Pressure Carbon Dioxide Type Fire Extinguishing Systems
Built-In Smoke and Heat Fire Detecting Systems

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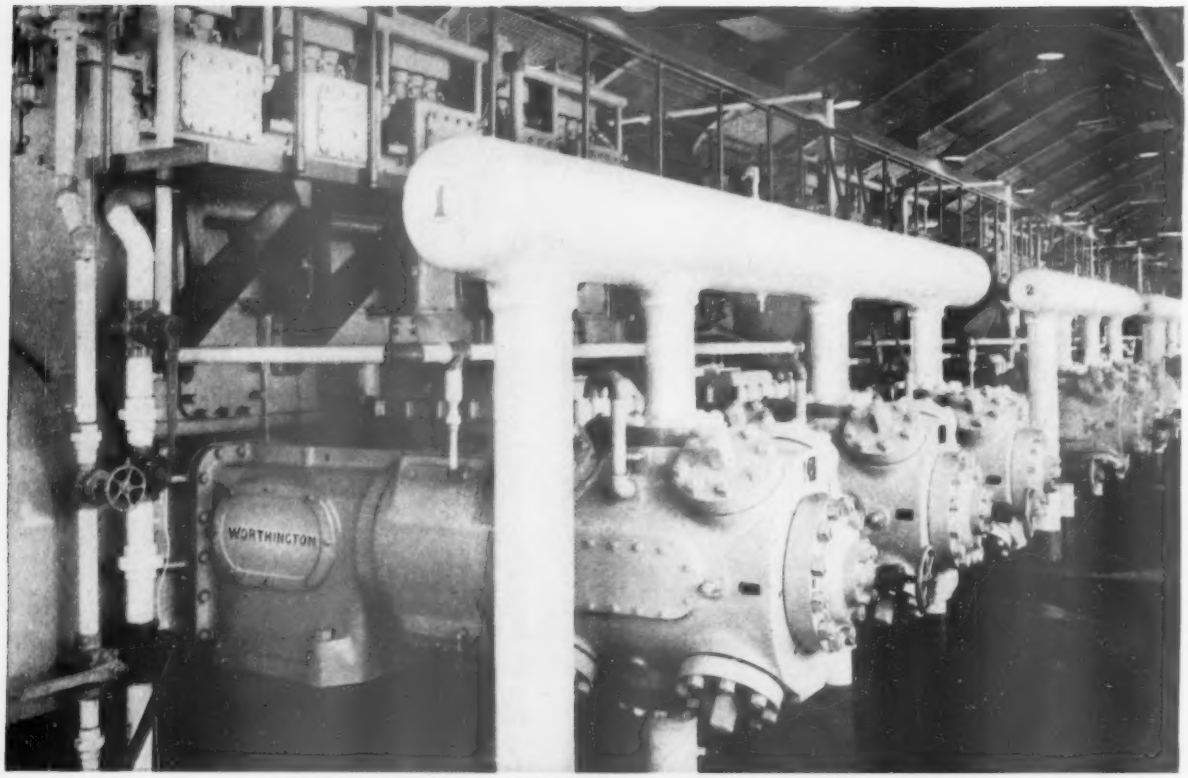
Sales and Service in the Principal Cities of United States and Canada

AFFILIATED WITH PYRENE MANUFACTURING COMPANY



10,000 HORSEPOWER IS DELIVERED by these ten Worthington UTC Engine-Compressors in the Navajo Station of the El Paso Natural Gas line. Two 2000-hp Worthington UTC compressors are planned for the company's pending expansion at this station. They will handle a total of 687,000,000 cubic feet of gas when the installation is completed.

Here's the right unit for any gas compression job

• More and more leading names in industry are turning to Worthington UTC Uniflo Engine Compressors as the most dependable and efficient means of compressing gas.

The installation shown here is just one of the many Worthington-equipped plants throughout the country. The long, dependable service these plants have obtained from their Worthington equipment is responsible for the fine reputation the UTC's have earned.

Performance reports show that the operating economy of these units, under conditions of fluctuating gas flow and pressure, is unsurpassed. That's because over half a century of testing and research has gone into making the Worthingtons the finest compressors obtainable.

In addition to pipeline gas compression, the versatile UTC's are operating on many other jobs such as pressure maintenance in oil wells, varied service in natural gasoline plants, processing petro-chemicals from natural gas, general process work, and many refrigeration applications.

Find out how a Worthington UTC can improve your gas compression operations. Get in touch with your nearest Worthington district office or write directly to Worthington Corporation, Engine Division, Section EK.3.3, Buffalo, N.Y.

EK.3.3

WORTHINGTON

ONLY WORTHINGTON COMPRESSORS GIVE YOU FEATHER VALVE PERFORMANCE

Y-Type • Engine Starting • Horizontal • Portable • Radial • Gas Engine

Remember the trade marks "tt" and "TUBE-TURN" are applicable only to products of TUBE TURNS.

Engineered for endurance

THE TUBE-TURN Welding Neck Flange is the preferred choice for most severe piping services—resulting from high pressures, temperature extremes, or numerous fluctuations of substantial amount in either temperature or pressure or both. Due to its long-tapered hub which affords a smooth transition in thickness, the welding neck flange assembly has an endurance strength equal to that of pipe joined by butt welds.

You can fill all your requirements for Welding Fittings and Flanges from TUBE TURNS' complete line. For prompt, efficient service, call your nearby TUBE TURNS' Distributor. You'll find one in every principal city.

The Leading Manufacturer of Welded Fittings and Flanges

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A Division of National Cylinder Gas Company

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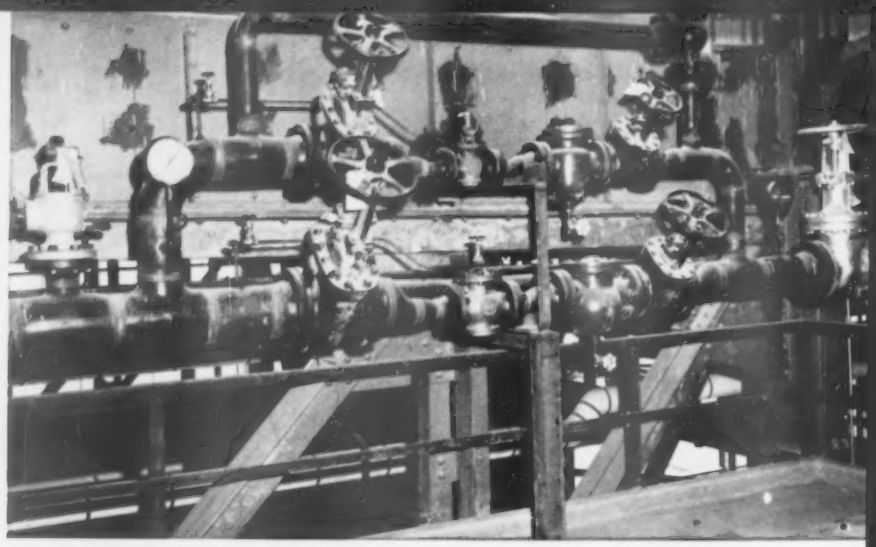
San Francisco • Seattle • Atlanta • Tulsa • Houston • Dallas • Midland, Texas

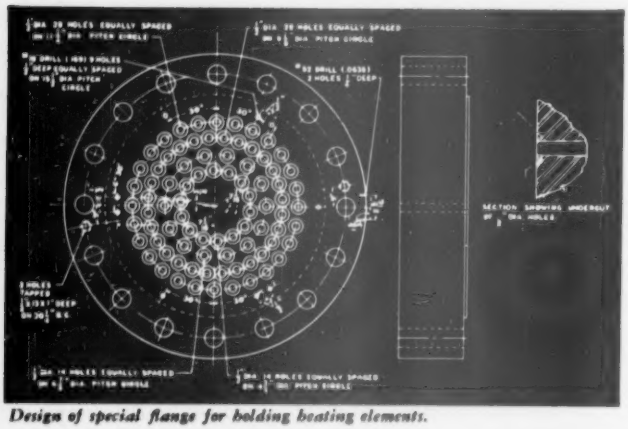
ENGINEERING SERVICE

YOUR NEEDS *in welding fittings and flanges are met efficiently and quickly by your nearby* TUBE TURNS' *Distributor. There are more than 4000 items in the complete line of* TUBE TURNS' *products. Example: carbon steel elbows from ½" to 42" diameter as shown.*



ACCURATE FIT-UP *is important in a header assembly like this. The uniform wall thickness and true circularity of* TUBE-TURN *Welding Fittings simplifies fabrication and installation of piping.*

Your problems solved by TUBE TURNS' ENGINEERING SERVICE



Design of special flange for holding heating elements.

MOST FLANGE NEEDS in industrial piping are filled by TUBE TURNS' ASA line of various types, sizes and materials. However, there are many exceptions . . ."specials" such as these: (1) lens ring flanges for use at 5300 psig and 400°F, with test pressure of 10,600 psig; (2) flanges in sizes from 14" through 72" for use at 30 psig and 400°F max.; (3) 2" flanges for high vacuum service at 400°F—950°F, and (4) various complex sheet tube flanges.

A "special" example is shown at the left, developed by TUBE TURNS' Engineering Service Division for E. L. Wiegand Co., Pittsburgh. It has 84 holes for heating elements. Flanges must withstand hydrogen-nitrogen mixture at 1000 psig at 750°F and 3000 psig at atmospheric temperature.

TUBE TURNS IS AT YOUR SERVICE!

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224 East Broadway, Louisville 1, Kentucky

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Company address _____

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Position _____

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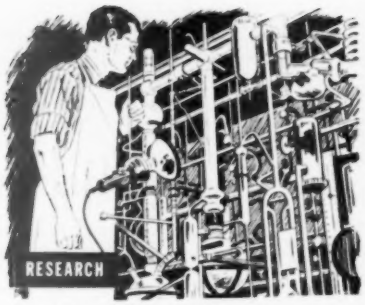
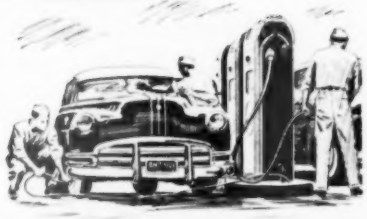
"TT" and "TUBE-TURN" Reg. U. S. Pat. Off.

TUBE TURNS
LOUISVILLE 1, KENTUCKY
A DIVISION OF NATIONAL CYLINDER GAS COMPANY

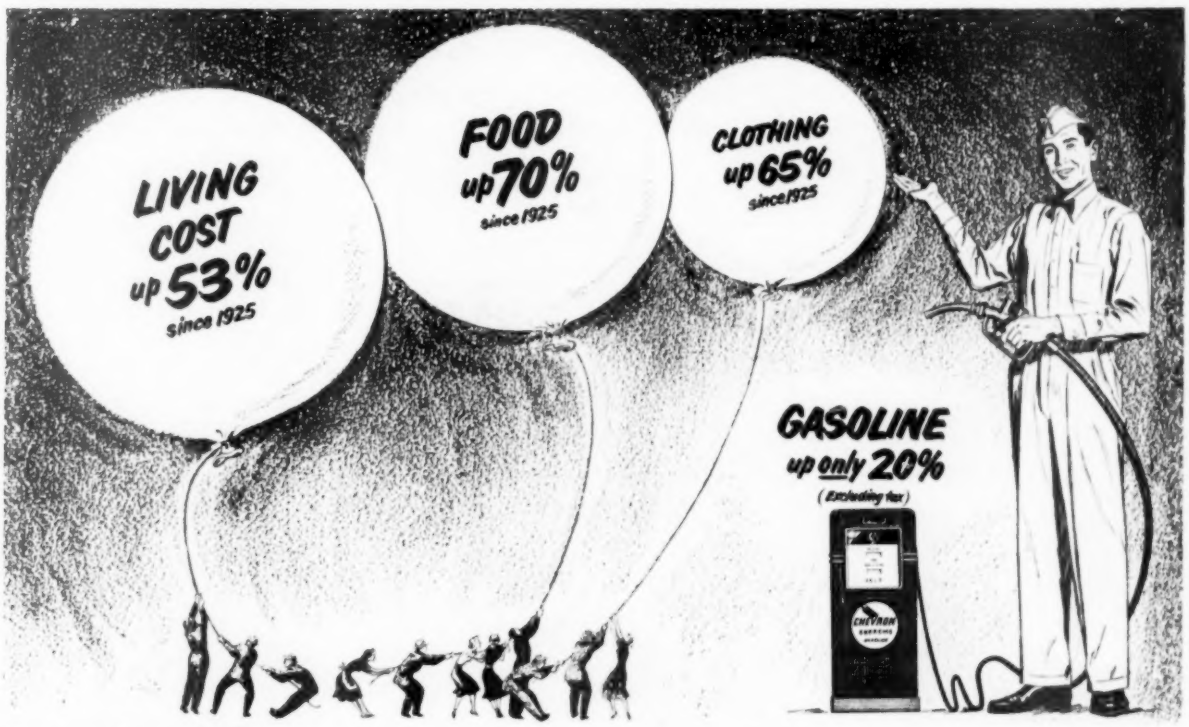


COMPETITION



Why gasoline is a real bargain today

Two facts lie behind the low price you pay for gasoline: oil companies work constantly through research to improve products and keep prices low, and they *compete intensely for your patronage*. That's why Standard opened the West's first petroleum research laboratory 32 years ago—and invests about $6 million annually in research.



One result you see here. Thanks to competition, gasoline prices (aside from taxes) have risen only 20% since 1925 . . . less than half as much as practically anything else you buy. But there have been other benefits for you, too. Research, motivated by competition, has resulted in a steadily improving gasoline. Two gallons of modern gasoline do the work that required 3 in 1925, and this has paved the way for lighter, more efficient car engines that give you more power, performance and economy. Competition and research have led to better gas station service, as well, and to the world-wide search that has discovered the largest known oil reserves in America's history. Last year, Standard Oil Company of California invested $225 million in exploration, new oil wells, improved facilities to keep pace with competition. The result is better gasoline at prices which make it one of the real bargains in your family budget.

75 years of planning ahead to serve you better

STANDARD OIL COMPANY OF CALIFORNIA

DO YOU KNOW THESE CITIES?

Each of them has its own unique personality. Individuality and hospitality, like the character of a great city cannot be mass produced. These distinguished hotels are not a chain but a group bound together by the highest standards of service to the public. They offer you:

- *Independent ownership and operation*
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- *Integrated national sales staff for your business and group meeting requirements*

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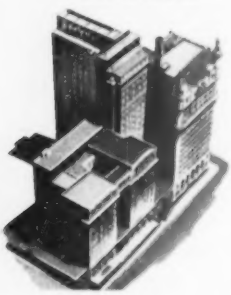

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How to Figure the cost of STEAM TRAPS

1. PRICE—you get a lot of trap for your money when you buy an Armstrong: big capacity in small size; the long-lasting mechanism in traps for low and medium pressures is identical in design, workmanship and materials, to that in traps for 900 degrees, 950 lbs. pressure!

2. INSTALLATION—Armstrong gives you a choice of body styles to save installation labor and pipe fittings.

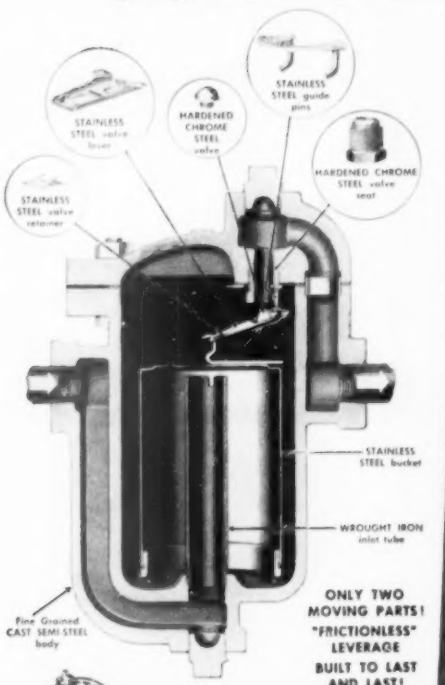
3. MAINTENANCE—Armstrong traps last longer! You save labor, parts cost and downtime. Freedom from leakage saves fuel.

Divide total trap cost by the life of the trap to get *costs per year*—this is where Armstrong traps really shine. Call your Armstrong Representative for the traps you need now, or write:

ARMSTRONG MACHINE WORKS
868 Maple Street • Three Rivers, Michigan

Full Facts In
FREE Catalog J

Catalog J, also an educational handbook on condensate drainage, gives sizes, prices and capacities of Armstrong traps. It tells how to select traps; how to make hook-ups; how to trouble-shoot. Send for a copy today.


STAINLESS STEEL valve lever
HARDENED CHROME STEEL valve
STAINLESS STEEL guide pins
HARDENED CHROME STEEL valve seat
STAINLESS STEEL valve retainer
STAINLESS STEEL bucket
WROUGHT IRON inlet tube
Fine Grained CAST SEMI STEEL body
ONLY TWO MOVING PARTS!
"FRICTIONLESS" LEVERAGE
BUILT TO LAST AND LAST!

STEAM TRAP CHECK LIST	ARMSTRONG TRAPS
Hardened chrome steel valve and seat?	Yes
All other parts stainless steel?	Yes
Long-lasting "frictionless" leverage?	Yes
Self-cleaning, non-clogging operation?	Yes
Choice of body styles?	Yes
Available with built-in strainers?	Yes
Available with internal check valves?	Yes
40 years inverted bucket trap experience?	Yes
Guaranteed *unconditionally* to satisfy?	Yes

ARMSTRONG STEAM TRAPS COST LESS!

ALCOA ALUMINUM

WHY?

SAVES MONEY

Alcoa Aluminum actually costs less than other corrosion-resistant metals. For example, Alcoa Heat Exchanger Tubes cost ½ the price of Admiralty, ⅔ the price of Mild Steel, ⅕ the price of Stainless. Alcoa Aluminum tank cars cost ⅓ less than stainless steel cars, and Alcoa Aluminum Coiled Tube costs up to 40 per cent less than copper.

HIGH HEAT CONDUCTIVITY

Aluminum (2S) has a thermal conductivity of 0.50 cgs units at 20° C, equivalent to 1,450 Btu per hour per square foot per inch of thickness per degree Fahrenheit. This high thermal conductivity is an advantage in the use of aluminum in equipment where efficient heat transfer is important.

RESISTS CORROSION

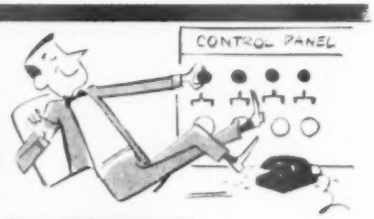
The high resistance of Alcoa Aluminum to attack by water, foods and many chemicals has led to the use of this metal in processing equipment of many kinds.

NONTOXIC

Alcoa Aluminum is resistant to attack by foods. Moreover, aluminum and its compounds are nontoxic. Aluminum equipment has found widespread use in the processing of foods and drugs.

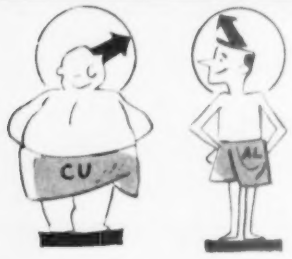
WON'T "SPARK"

Because of its nonsparking characteristics, Alcoa Aluminum is used with explosives or inflammable materials. Combined with its other advantages, aluminum is ideal for powder plant machinery, ventilator fans in industrial plants, shovels in mines and chemical plants, and containers and tanks for gasoline, as well as chemicals.



EASY WORKABILITY

Manufacturers find aluminum easy to machine, shape, form, cast, roll, extrude, forge and assemble with standard tools and machinery. It can be joined by all methods of welding. Also certain alloys can be brazed.



LIGHT WEIGHT

Alcoa Aluminum drums and barrels, tank cars and trucks have the advantage of light weight, easier handling and more pay load.

GOOD PERFORMANCE AT LOW TEMPERATURES

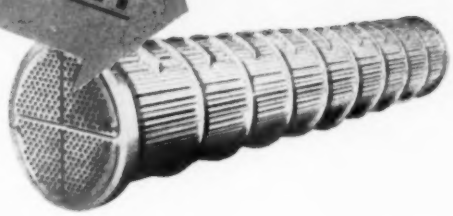
Down to —320° F, Alcoa Aluminum actually improves 23 per cent in yield strength, 80 per cent in elongation, 67 per cent in tensile strength. Millions of pounds of aluminum are now in use for tonnage oxygen production, nitrogen removal, dewaxing, propane chilling, ethylene extraction and many other low temperature processes.

PROTECTS PRODUCT PURITY

Alcoa Aluminum will not discolor or harmfully contaminate products processed in it. It will not deteriorate lubricating oils nor form sludge or gum. Leading process engineers specify aluminum processing equipment for such compounds as acetic acid, naval stores and hydrogen peroxide.

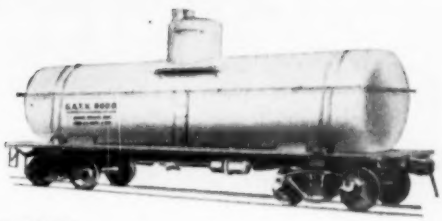
is used in the Process Industries

WHERE?



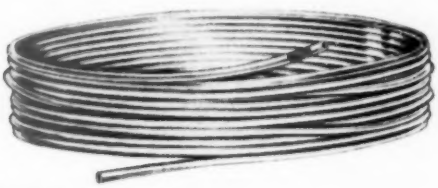
HEAT EXCHANGER TUBES

An average-sized refinery can save $50,000 in first cost by using Alcoa Aluminum Tubes. For details, write for our free booklet, *Alcoa Aluminum Heat Exchanger Tubes.*



TANK CARS

Ask your car builder about the advantages of lightweight aluminum rolling stock. Or better still, write Alcoa. We have facts and figures on hundreds of liquid ladings that can be safely, economically shipped in aluminum.



COILED TUBE

Alcoa Utilitube® is made of a specially selected alloy providing easy workability and high fatigue strength. It's used for pneumatic control circuits, fuel lines, lubricating lines and hydraulic systems. For details, write for the free booklet, *Alcoa Utilitube.*

PIPE

Alcoa Aluminum Pipe and Fittings offer many advantages to the chemical, petroleum and food processing fields. Also used for oil, gas, water, compressed air and mine drainage pipe lines. Write for the booklet, *Alcoa Aluminum Pipe and Fittings.*

STORAGE TANKS

Purity of many chemicals is protected by storage in aluminum tanks, ranging in size from the very smallest to more than 200,000 gal. capacity. We'll gladly send you the names of reputable fabricators of aluminum storage tanks.

ALCOA
ALUMINUM

ALUMINUM COMPANY OF AMERICA

ALUMINUM COMPANY OF AMERICA
904-C Alcoa Building, Pittsburgh 19, Pa.

I would like more information on:

- ☐ Alcoa Heat Exchanger Tubes
- ☐ Alcoa Utilitube
- ☐ Alcoa Aluminum for Tank Cars
- ☐ Alcoa Aluminum Pipe
- ☐ Aluminum Storage Tank Fabricators

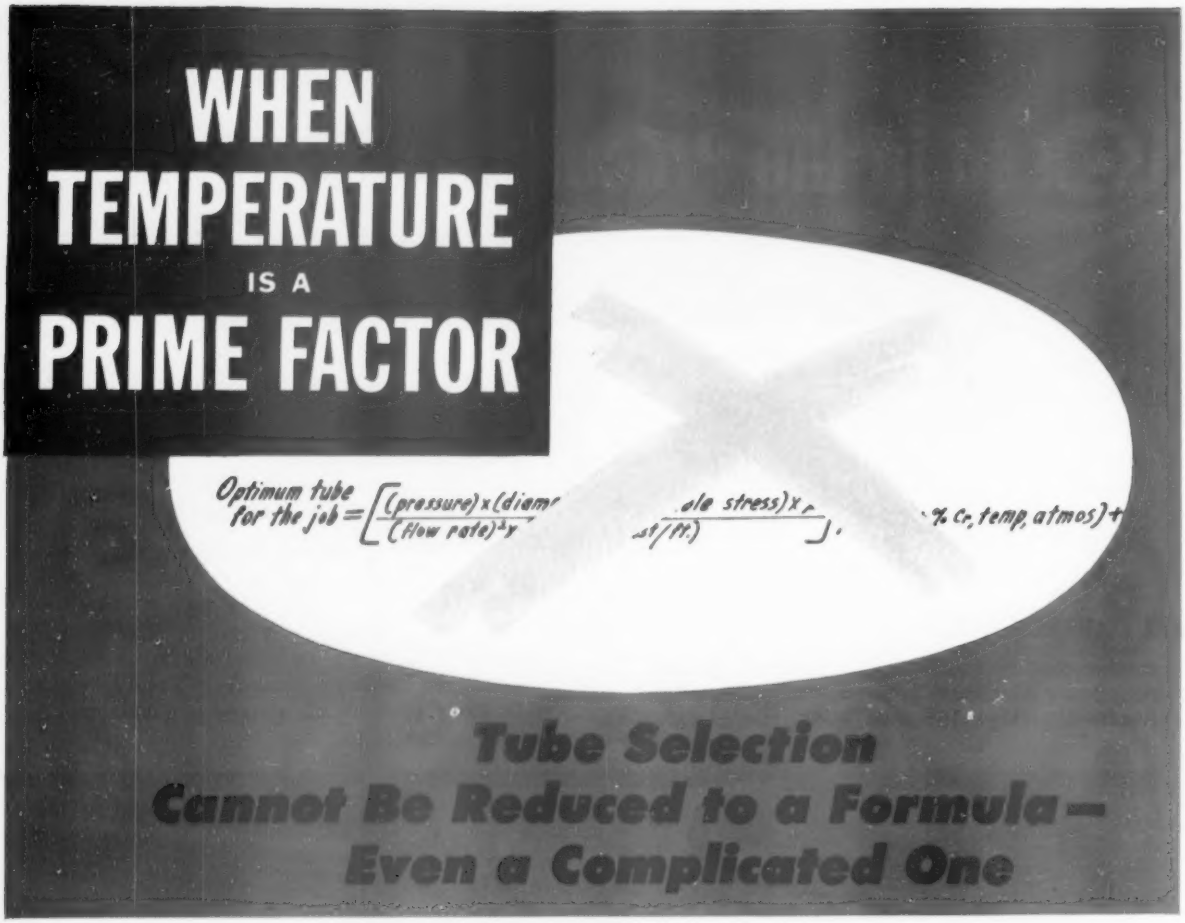
Name _____

Title _____

Company _____

Address _____

WHEN TEMPERATURE IS A PRIME FACTOR



Tube Selection Cannot Be Reduced to a Formula — Even a Complicated One

Many variables are involved in the selection of the optimum tubing for a specific high temperature application. If the tubing is also to operate under high stress, perhaps the most important variable to be considered is mechanical strength.

In general, the mechanical strength of a steel decreases as the temperature increases. Some steels, however, retain more of their strength at elevated temperatures than others. For instance, at 300F, the ultimate strength of both carbon steel and B&W Croloy 18-8 (Type 304) is about 70,000 psi. At 1200F, however, carbon steel is about 12,000 psi while Croloy 18-8 is about 44,000 psi.

To evaluate the characteristics of metals operating under stress at high temperatures and over long periods of time, B&W has performed stress rupture tests and creep tests on a great number of tubing steels.* The results of these tests help engineers to determine the proper tube to be used in specific applications.

Other factors beside mechanical strength, however, must be considered in choosing the optimum tubing for a specific high temperature application. Some of these factors are—oxidation resistance, tube size, tube cost, flow rates, and rates of conductivity and expansion.

It takes an expert to specify the right tubing for any particular application, and there is no substitute for the kind of experience with these problems you'll find at B&W.

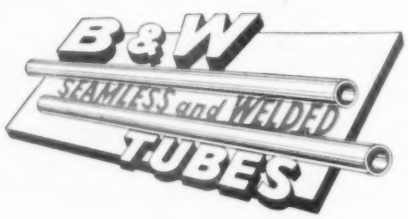
To get the most benefit from B&W's long experience in matching tubes to jobs, call on Mr. Tubes, your nearby B&W Tube Representative. He can help you make the best choice.

Data shown in

TDC 102 Creep Stress Data on B&W Croloys

TDC 153 Stress Rupture Data on B&W Croloys available free on request.

THE BABCOCK & WILCOX COMPANY
TUBULAR PRODUCTS DIVISION
Beaver Falls, Pa.—Seamless Tubing; Welded Stainless Steel Tubing
Alliance, Ohio—Welded Carbon Steel Tubing



TA-4023 (P)

the new LORAIN MC-104 MOTO-CRANE® is heading your way!

Panhandle Eastern Pipeline Co. of Kansas City, Missouri, find the new, low-priced Lorain Moto-Crane, model MC-104 equipped with Hoe boom ideal for pipeline construction.

PRICE IS LOW

Get set for a "bargain in quality". Your Thew-Lorain Distributor is now ready to give you all the details about the new "MC-104" Moto-Crane, in the ⅜-yd. class. He's ready to quote you prices that will please you for the machine to fit your needs . . . and he's ready to show you why you get more for your money. It's here — ready for your jobs — the *lowest-priced* Moto-Crane your money can buy!

QUALITY IS HIGH

And when it comes to design quality, Lorain experience is behind this new "baby". Don't let the low price fool you! You get an entirely new 45 m.p.h. "6x4" Moto-Crane Carrier. Ten big 9:00x20 tires provide soft-ground flotation and Equalizer Rocker Beams provide constant ground contact and tractive effort for off-the-road travel. Mounted on this sturdy Carrier, with 15" deep side frames, is a turntable that has "borrowed" heavily from the field-tested Lorain "TL" series. It's big machine design. For example, there are 18 anti-friction bearings on the clutch shaft alone.

SELECTION IS COMPLETE

Then, to give you a machine that will fit all of your present and future jobs, you can select from all 5 interchangeable front ends — shovel, clamshell, dragline, hoe and crane — with its many attachments. Never before have you been able to get so much quality . . . so much selection . . . at such low cost! You must see the "MC-104" to fully appreciate its value. Phone your Thew-Lorain Distributor today . . . and the "MC-104" will head your way.

THE THEW SHOVEL CO., LORAIN, OHIO, U. S. A.

YOU GET MORE . . . IN THE "104"

PHONE TODAY . . . WE'LL HEAD YOUR WAY!

This is an invitation from your Thew-Lorain Distributor to show you the new "MC-104" in action. Before you buy any shovel-crane in the small machine field, it will pay you to see why . . . "You get more in the 104".

THEW LORAIN®

NEW FREE

JUST OFF THE PRESS — A new catalog completely describing the features of the new Lorain "MC-104". Send for your free copy today.

GET YOUR COPY . . . NOW!

"Don't build up an inventory
... make use of METAL GOODS CORPORATION'S
large warehouse stocks!"

NO NEED TO TIE UP YOUR MONEY IN METAL STOCKS

Take advantage of our metal supply service—it's practically as fast as getting the stock right from your own racks—and it saves you money in the bargain! You see, whether you use Aluminum, Brass, Bronze, Copper, Monel*, Inconel*, Nickel*, Steel or Stainless Steel, Metal Goods Corporation can supply it, in practically any commercial form, quickly and completely! Hundreds of large and small users of these metals are letting us solve their metal supply problems and benefiting by it—in money and floor space saved—in payroll and overhead avoided. Give it a try—call your nearest Metal Goods Corporation representative today. You'll find him anxious to serve you.

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Ray Noller
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Charles I. MacKenzie
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C. M. Cooley
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Harry L. Newton
Phone: 5-1232

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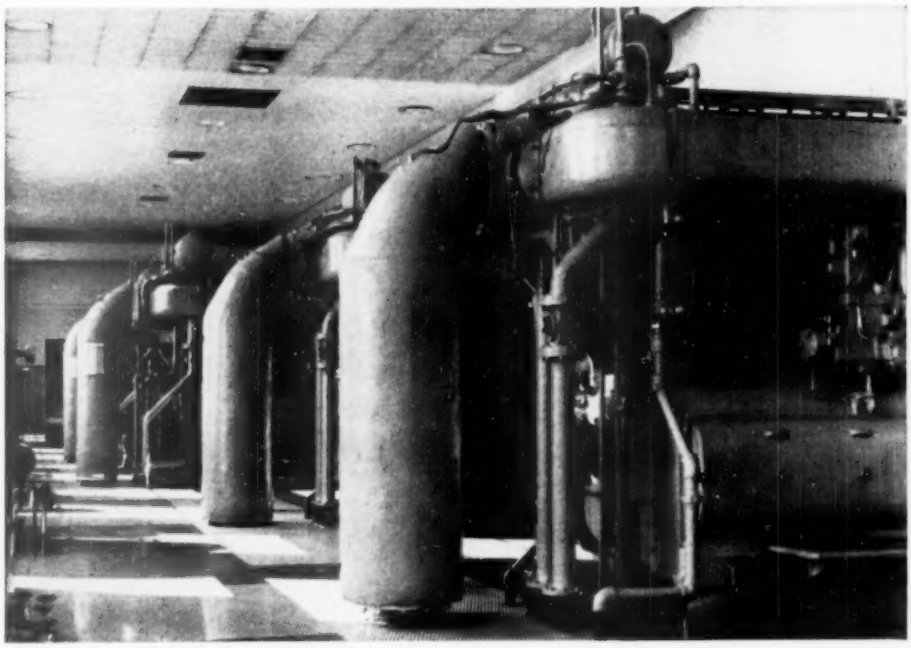
GENERAL OFFICES: ST. LOUIS 15, MISSOURI

Another Pipe Line Company Reports

2 to 3 times more horsepower hours

. . . after installing Koppers Conformable Oil Rings



Koppers Porous Chrome* Rings. Porous chrome surface holds and distributes oil during break-in. Seats quickly. This chrome prevents grit from embedding in ring surface. Prevents cylinder wall scratching. Reduces wear 50%. Last 4 times longer than other rings.

Koppers Conformable Ring maintains constant unit pressure for positive oil control. Conforms readily to meet cylinder distortion because flexible cast iron member is pressed outward by abutment type spring which exerts uniform radial pressure around entire circumference.

*Van der Horst Process

Here's proof that Koppers Piston Rings increase operating efficiency.

Prior to using Koppers Conformable Oil Rings, a pipe line company reported average oil consumption as approximately 3500 to 4000 horsepower hours per gallon. Now they are getting 2 to 3 times that much.

In addition to this large saving in oil consumption, they find they get longer periods of satisfactory operation between overhauls.

As a result, this pipe line company has adopted Koppers Piston Rings as standard equipment on all their 12½" x 13" turbo-charged engines.

Does this suggest possible savings in your operation? Less oil consumption? Less down time, lower labor costs? Then investigate Koppers Porous Chrome* and Conformable Oil Rings. And install them next time you have a piston ring replacement job.

Write for special assistance from our experienced technical staff. No obligation, of course . . . . and mail the coupon for special conformable ring folder.

KOPPERS®

AMERICAN HAMMERED
Industrial Piston Rings

METAL PRODUCTS DIVISION • KOPPERS COMPANY, INC. • Baltimore, Maryland
This Koppers Division also supplies industry with Fast's Couplings, Aeromaster Fans, Koppers Electrostatic Precipitators and Gas Apparatus.

Engineered Products Sold with Service

KOPPERS COMPANY, INC., *Piston Ring Dept.,* **1691 Hamburg Street, Baltimore 3, Md.**
Gentlemen: Please send me full information on your Conformable Oil Ring.

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Company .....
Address .....
City ..... Zone ..... State .....

DON'T
. . . tie on your rotary hose with a winch line when taking the hose out of the crate. It squeezes it . . . kinks it . . . twists it.
. . . and remember that best hose performance is yours if you have New York Belting & Packing Company's Green Triangle Rotary Hose on your rig. It has all the features you should demand in a rotary hose.
DO
. . . use a carrier in which to store the hose for transportation and handling.
CONTINENTAL
Serving the Oil and Gas Industries
NYB&P

THESE EXCLUSIVE PRECISION-MACHINED GUIDES

eliminate chatter

lengthen service life

IN LUNKENHEIMER

IRON BODY GATE VALVES

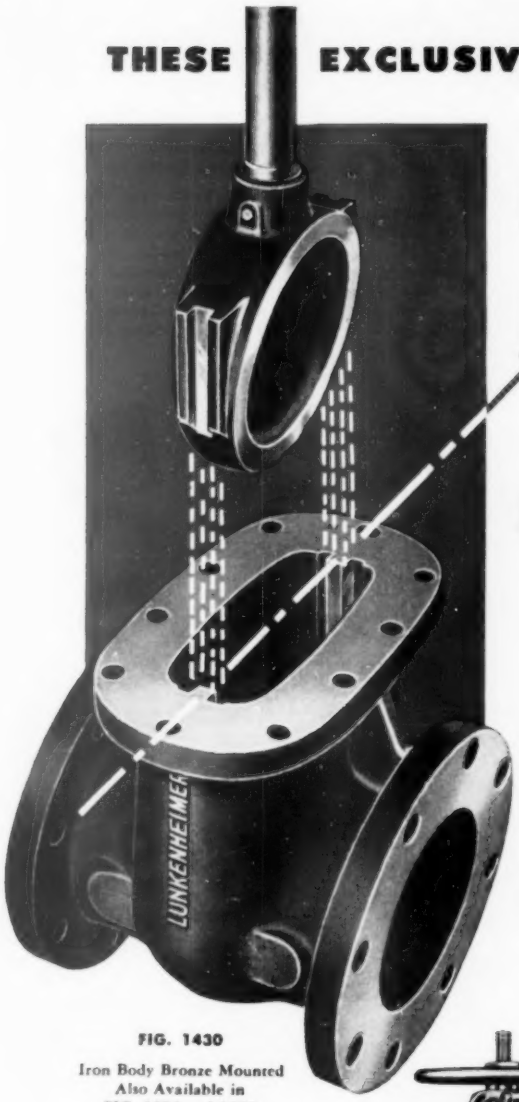
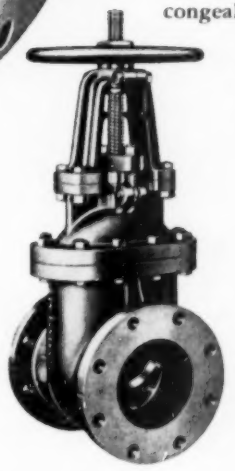


FIG. 1430

Iron Body Bronze Mounted
Also Available in
FIG. 1576 and 1578
All Iron
Screwed and Flanged Types
Fig. 1578N-4
3% Nickel Iron with
18-8 Mo (Type 316) Stainless Steel Trim

Gate valve chatter — the sound of wasteful, accelerated wear — is eliminated by Lunkenheimer's unique method of manufacturing Iron Body Gate Valves. Not only are the guide channels in the disc accurately machined, but the guides in the body as well. These precision-machined guides hold the disc firmly in line — prevent pressure from forcing the disc against the opposite seat. Result: no clatter, no chatter, and much longer valve life. The complete Lunkenheimer Iron Body Gate Valve line includes 3% Nickel Iron Gate Valves (Fig. 1578N-4) designed especially for mildly corrosive service in the oil, paper, and chemical processing industries. They have 18-8 Mo (Type 316) Stainless Steel and Monel Trim to protect the seating faces. All Lunkenheimer Iron Body Gate Valves feature solid discs without pockets that might trap congealing substances in the line. They also have handy swing-bolts and shelves that make repacking easy — are ideal for service in the chemical, petroleum, and pulp processing fields.



WRITE FOR Circular 564, describing the complete Lunkenheimer Iron Body Gate Valve line. Address: The Lunkenheimer Co., Box 360F, Cincinnati 14, Ohio, or phone your Lunkenheimer Distributor.

LUNKENHEIMER
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QUALITY

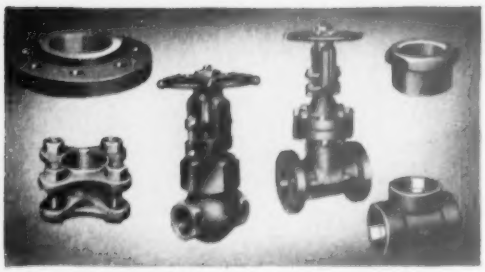
IRON • STEEL • BRONZE

LUNKENHEIMER®

THE ONE *Great* NAME IN VALVES

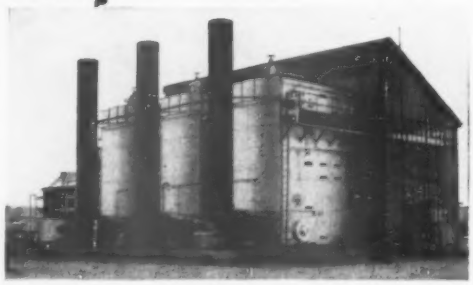
L-253-98

Designed for today's *Tough* service demands



DROP FORGED VALVES AND FITTINGS FOR TOUGHNESS AND TROUBLE-FREE SERVICE

Drop forged from carbon and alloy steels, Vogt valves, fittings and flanges will safely handle liquids and gases at high pressures and high temperatures in power plants, chemical plants, petroleum refineries, etc. The complete line includes flanged, screwed and socket weld end globe, gate and check valves—ells, tees, and crosses—couplings—bushings—plugs—unions—flanges and flange unions—and welding heads.

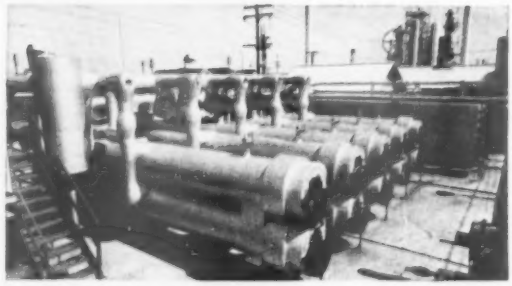


MODERN STEAM GENERATORS

Vogt steam generators are designed to give maximum rating in a minimum of space, with high efficiency and low maintenance expense. Bent tube types and straight tube, forged steel sectional header types to burn solid, liquid or gaseous fuels meet every power, process or heating requirement.

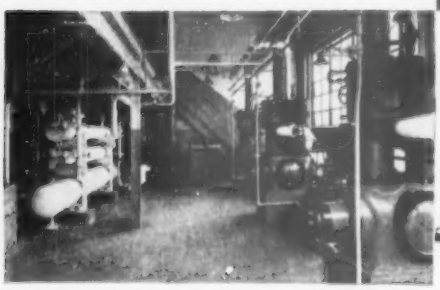
PROCESS EQUIPMENT FOR EVERY SERVICE

Vogt constructs process equipment in wide variety to all Codes. Stills and towers, oil chillers, crystallizers, heat exchangers, molding machines, etc., serve in the manufacture of oils, greases, 100 octane gasoline, synthetic rubber, chemicals and related products around the world.



SPECIAL MATERIALS COMBAT CORROSION AND PRODUCT CONTAMINATION

Our modern shops produce a wide variety of equipment from special metals and alloys to fight corrosion and product discoloration or contamination. Fabrication procedures insure that corrosion resistant properties of welds will match that of the materials used to construct the equipment.



MORE REFRIGERATION TONNAGE AT LESS COST

More than 70 years of engineering and manufacturing experience is incorporated in Vogt refrigerating and ice making equipment. Absorption Systems, Compression Systems, and Tube-Ice Machines in a wide range of capacities serve industrial and processing plants, and institutions, here and abroad.

Vogt

PRODUCTS

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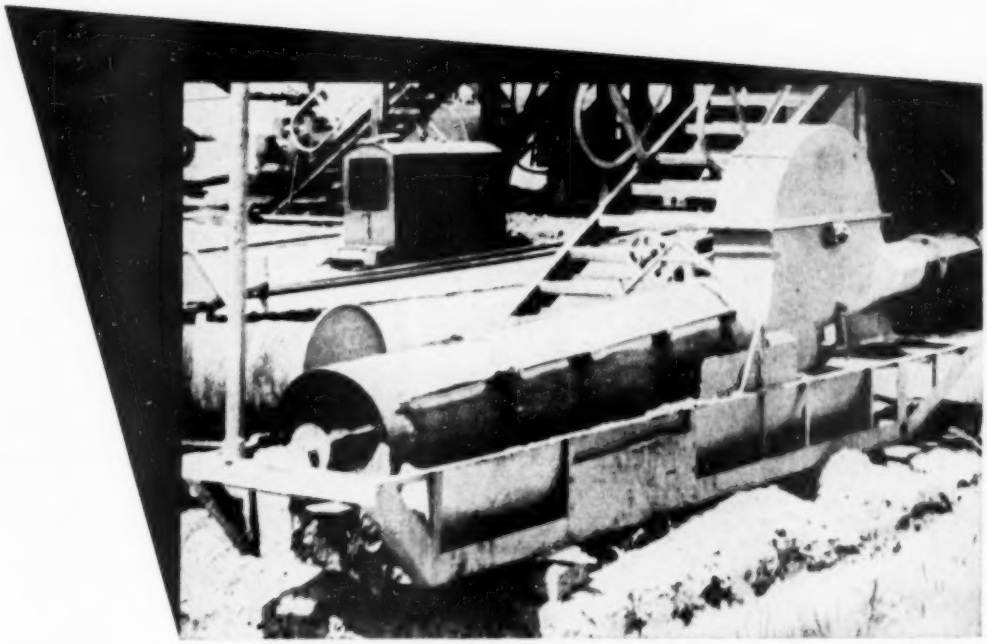


Thompson shale separators are entirely self-motivated, requiring no motors or external sources of power. All Thompson separators are equipped with a Sample Machine which collects cuttings for a foot-by-foot analysis. Specific information can be obtained by writing to Thompson Tool Co., Iowa Park, Texas. Thompson separators are orderable from all supply stores.

How Monel Screen Cloth Resists Abrasion and Corrosion to Keep Drilling Mud Serviceable

If your operations involve screening, separation or filtration, you'll appreciate the problem that was faced by Thompson Tool Company. Their equipment is exposed to unusually tough service: reclaiming drilling mud that is loaded with shale and other abrasives.

The wire screen cloth not only has to withstand abrasion, but also corrosive attack by caustic and other chemicals in the mud as well as the muriatic acid used to clean the screens.

They tried a number of different screen materials before deciding several years ago, that Monel had the physical and corrosion-resisting properties they need. Since then Monel screen cloth has been standard equipment.

Oilmen, equipment manufacturers and industrial users have found that:

Monel has corrosion resistance that successfully resists most acids, alkalies, salts, water and atmospheric conditions.

Monel has greater durability — its strength and toughness enable it to withstand heavy pressures and hard wear and tear.

Monel is easy-forming — it can be made in any size or shape wire cloth for filtering hydraulic oil, water, chemical solutions, brines, alkalies, acid sludges, or other applications when corrosion resistance and product purity are important.

If you would like more information on Monel Screen Cloth and the names and addresses of wire weavers, write Inco for a copy of "Established Weavers of Monel — Nickel — Inconel®".

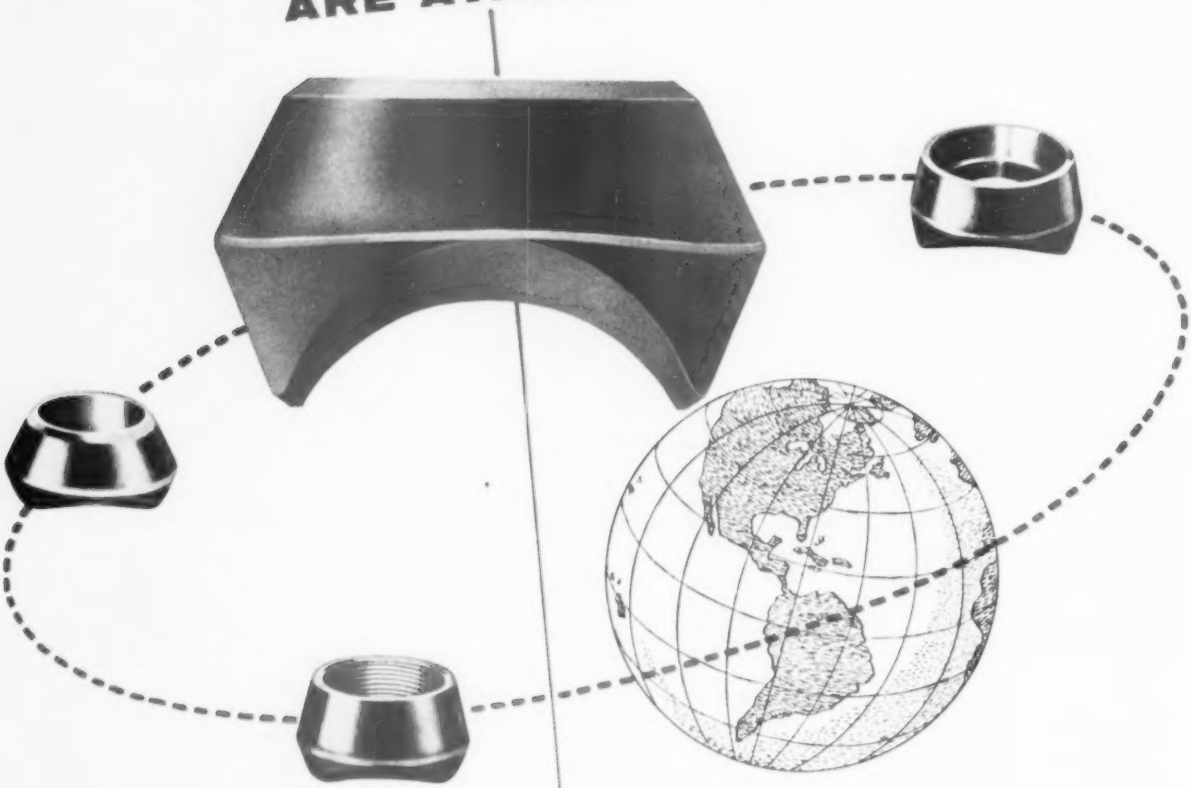
INCO TRADE MARK

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York 5, N. Y.

Monel ... *for Minimum Maintenance*

Where in the world do you need fittings?

BONNEY WELDING FITTINGS ARE AVAILABLE EVERYWHERE



Sold by leading distributors throughout the United States, Canada and Overseas, Bonney Weldolets and Thredolets are immediately available in Carbon Steel, Stainless, Chrome Moly, Monel, Wrought Iron, Aluminum and other alloys. Complete distributor stocks are available in all principal cities—backed up by factory stocks of all sizes, weights and grades of material for immediate shipment. Bonney Welding Fittings are performance-proved, assuring full pipe strength on 90° branch joints . . . large and small, full size and reducing.

DISTRIBUTORS
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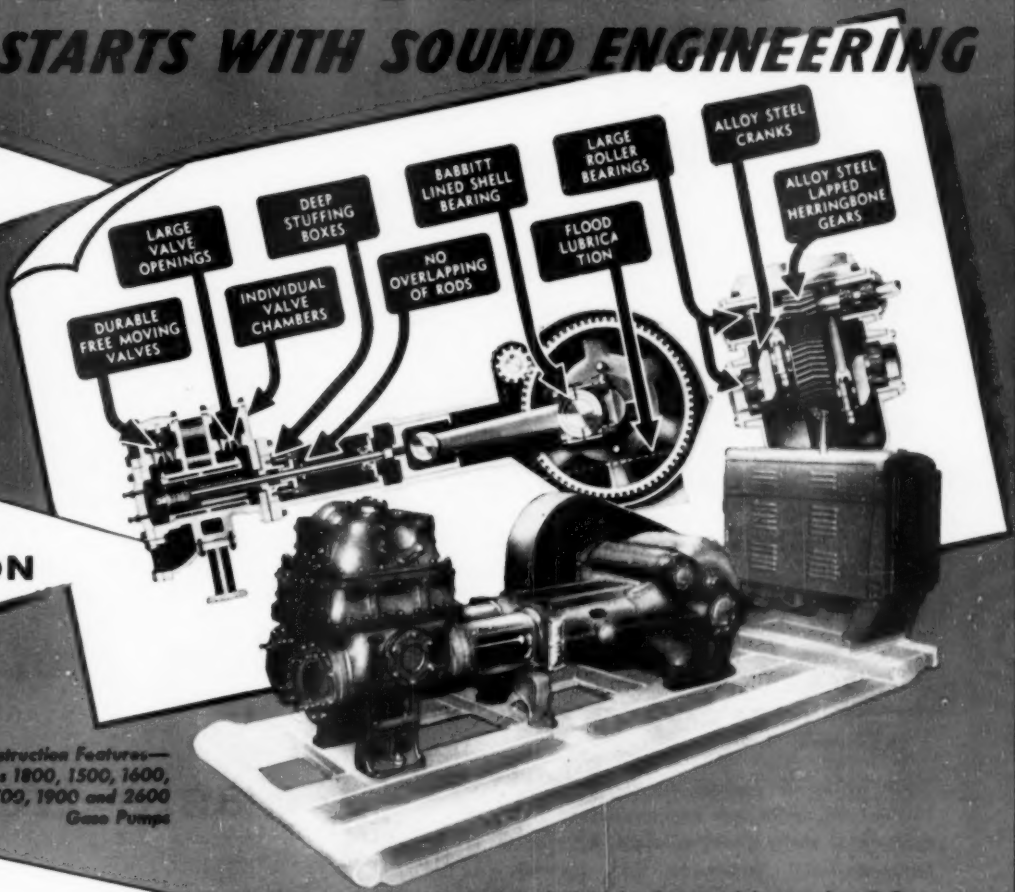
3-D PERFORMANCE

STARTS WITH SOUND ENGINEERING

DEPENDABLE OPERATION

DURABLE CONSTRUCTION

DRAMATIC SAVINGS



Typical Construction Features—
Series 1800, 1500, 1600, 1700, 1900 and 2600 Gaso Pumps

Pipe line men with their technical background know that 3-D pump performance is never accidental. The Gaso combination of Dependability, Durability, and Dramatically low operating costs is the direct result of engineering geared to the principle of fewer parts made extra-strong to withstand the most rugged conditions of service for unbelievably long periods of time. Let us send you our latest catalog.

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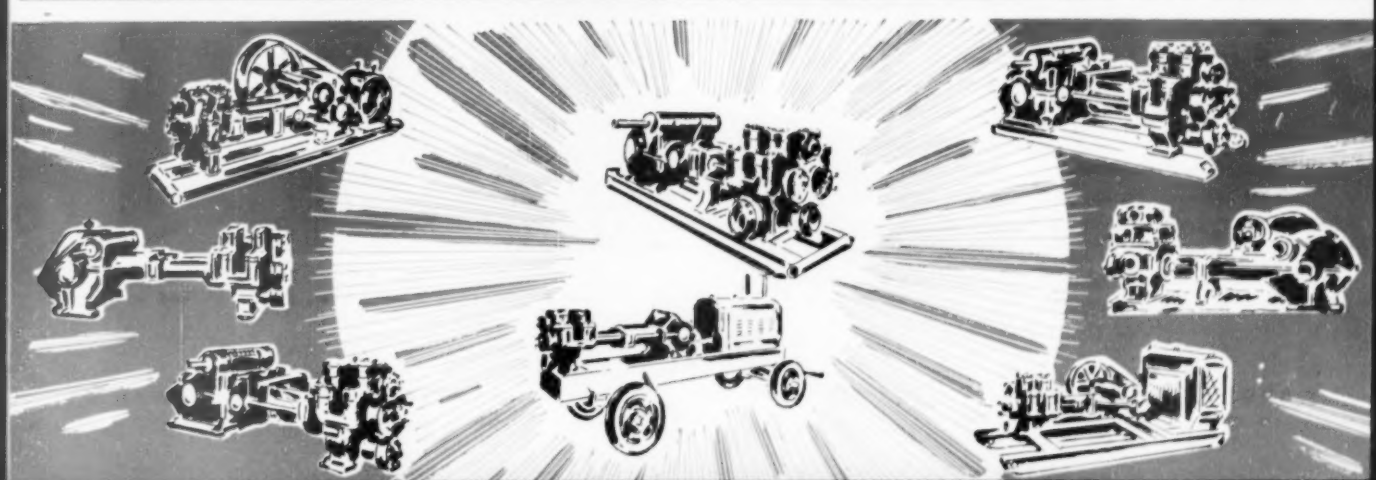
GASO PUMPS
for every oil industry need



From one source . . . any instrumentation you need

When it comes to measurement and control, every industrial process is different. Each demands its own combination of accuracy, economy, instrument ranges, and all the numerous other characteristics that are peculiar to the individual application.

No single instrument and its accessories could possibly fit every process. So Honeywell makes a broad variety of measuring and controlling equipment that spreads across a tremendous range of applications.

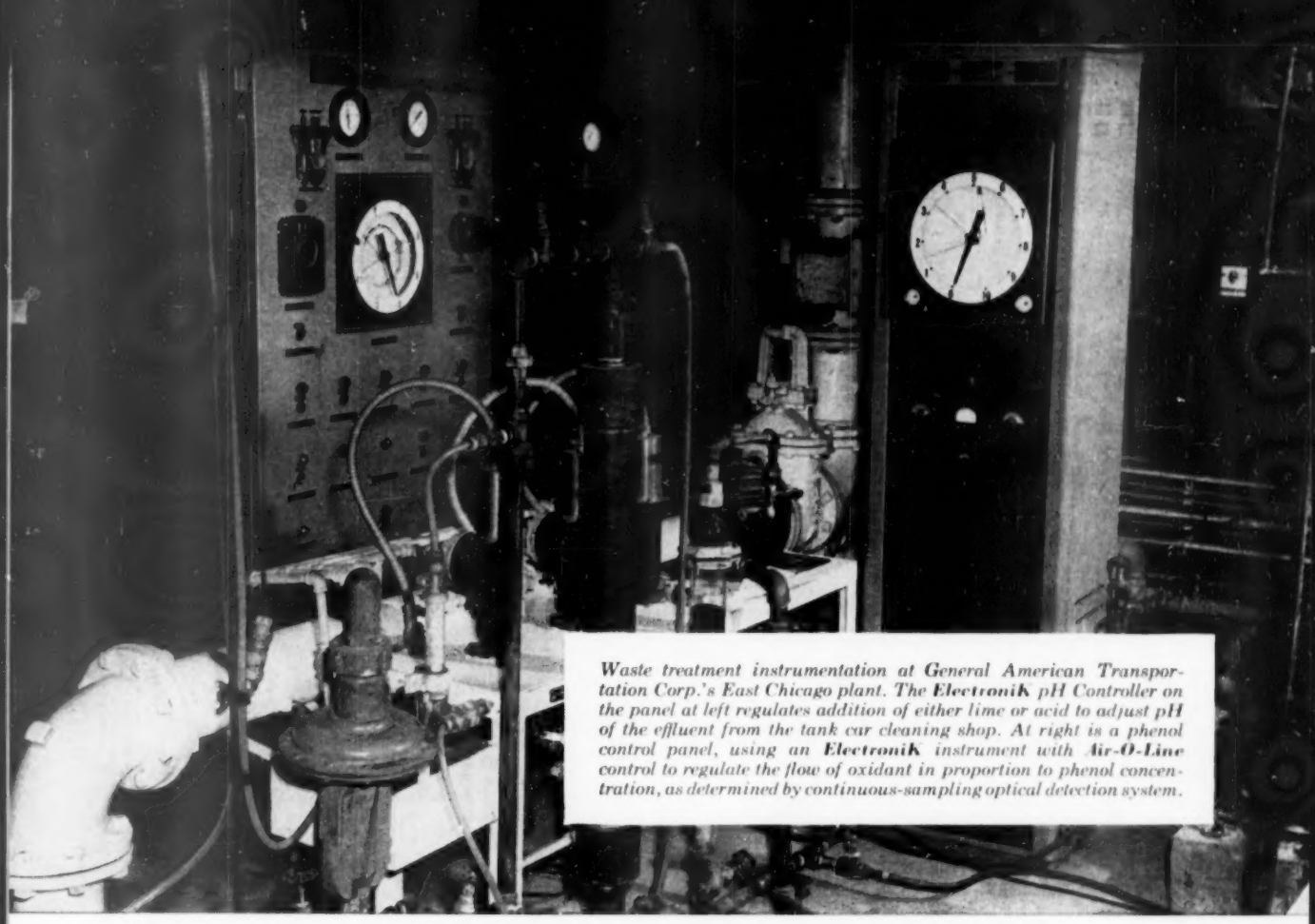
The advantages are two-fold. First, you can get all the instrumentation your process requires from a single source, so there is undivided responsibility for the complete installation. And second, you are assured that the equipment selected for your process is recommended without bias . . . neither over-sells nor under-equips . . . needs no stretching, squeezing or compromising to fit it to its assignment.

This versatile family includes *ElectroniK* indicators, recorders and controllers in circular and strip chart models, applicable to temperature, pressure, pH, power and dozens of other variables; square root flow meters for control applications; evenly graduated flow meters for cost accounting; thermometers, pressure gauges and liquid level meters; *Pyr-O-Vane* millivoltmeter controllers. Especially useful for graphic panels are the *Tel-O-Set* miniature indicators, recorders and controllers. Electric and pneumatic control systems range from the simplest to the most complex, including automatic program controls and complete systems developed for particular processes.

Working with these instruments is a full choice of primary elements . . . thermocouples, *Radiamatic* radiation elements, pressure-type and electrical resistance thermal systems, flow meter bodies, pH cells and many others. For final control elements, you can choose from a wide range of electric motorized and diaphragm operated valves. To complete the picture, there are more than 7000 non-indicating devices for controlling temperature, pressure, vacuum, liquid level and humidity . . . an unmatched variety of instrumentation made by the world's largest manufacturer of control equipment.

New methods of waste treatment aided by . . . .

Phenol concentration in final effluent at a large refinery is checked by infra-red spectrometer, which utilizes an ElectroniK instrument to record data.



Waste treatment instrumentation at General American Transportation Corp.'s East Chicago plant. The ***ElectroniK*** *pH Controller on the panel at left regulates addition of either lime or acid to adjust pH of the effluent from the tank car cleaning shop. At right is a phenol control panel, using an* ***ElectroniK*** *instrument with* ***Air-O-Line*** *control to regulate the flow of oxidant in proportion to phenol concentration, as determined by continuous-sampling optical detection system.*

ElectroniK instrumentation

MANUALLY regulated, batch-type treatment of industrial wastes is rapidly being superseded by fully automatic, continuous processes that utilize *ElectroniK* instrumentation to the fullest extent. The advancing technology of waste treatment recognizes that this problem is one of chemical engineering—and consequently can benefit by the same processing and control techniques that have sparked progress in production operations.

Instrumentation used by General American Transportation Corporation is an excellent example of modern methods. Used for the treatment of phenol and oil bearing wastes from tank car cleaning, it affords pin-point accuracy capable of detecting phenol concentrations as small as 0.001 part per million. Under control of *ElectroniK* instruments, the process functions continuously with minimum operating costs, reduced storage capacity and peak throughput. The instruments analyze chemical concentration, make a permanent record of effluent characteristics, and automatically regulate the addition of reagents.

Versatile *ElectroniK* instrumentation can help reduce your plant's share of the cost of preventing stream pollution . . . by eliminating the expense of laboratory analysis, reducing treatment plant labor requirements and cutting chemical consumption. Your nearby Honeywell sales engineer will be glad to discuss your waste problem . . . and he's as near as your phone. MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.

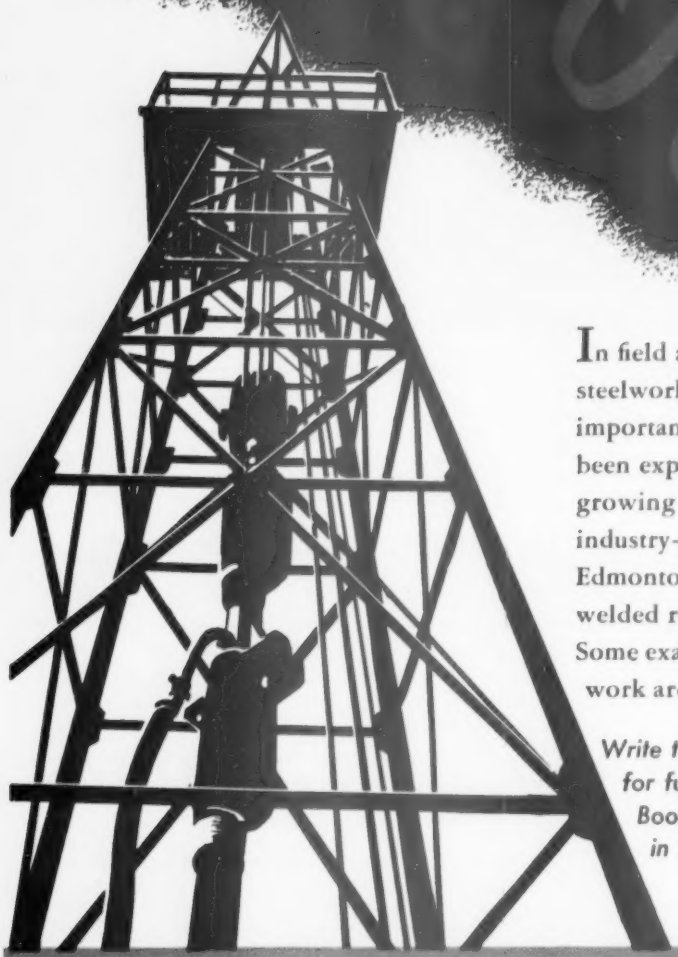
● **REFERENCE DATA:** Write for Bulletin 7302, "Instrumentation for Water, Sewage and Industrial Waste Treatment".

MINNEAPOLIS **Honeywell**

BROWN INSTRUMENTS

First in Controls

SERVING CANADA'S *Oil Industry*

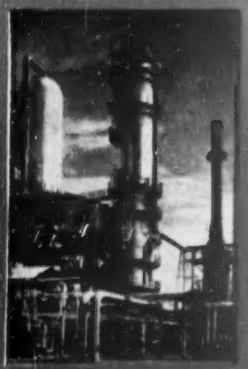


In field and refinery operations custom steelwork by Dominion Bridge plays an important role. Our Western plants have been expanded and re-equipped to meet the growing needs of Canada's thriving oil industry—including complete facilities at Edmonton for the fabrication of Class I welded refinery pressure vessels. Some examples of our work are shown below.

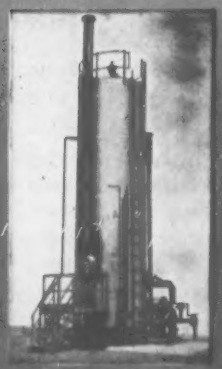
Write to Box 280, Montreal, for fully illustrated Booklet BSE "Builders in Steel".

DOMINION BRIDGE
COMPANY LIMITED

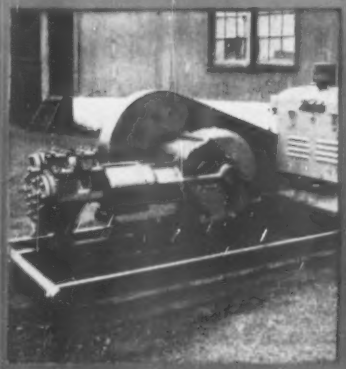
FRACTIONATOR TOWERS



TREATER UNITS



PUMPS



OIL STORAGE TANKS

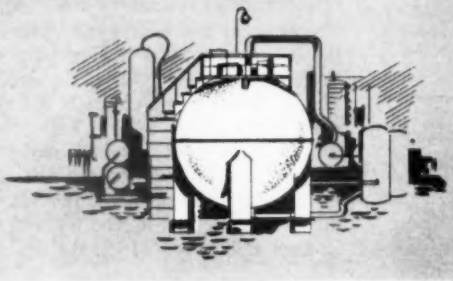
DIVISIONS STRUCTURAL PLATEWORK, BOILER, MECHANICAL, WAREHOUSE

Plants at: MONTREAL, OTTAWA, TORONTO, WINNIPEG, CALGARY, VANCOUVER,
Assoc. Companies at: AMHERST, N.S. QUEBEC, SAULT STE-MARIE, EDMONTON

THESE PETRECO ELECTRIC PROCESSES

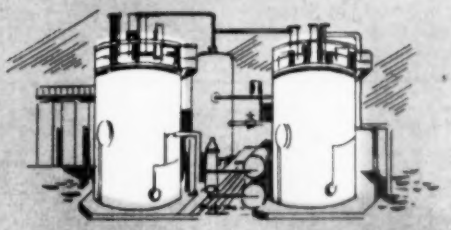
Help refiners to run more crude, treat distillates more efficiently, increase profits substantially.

DESALTING



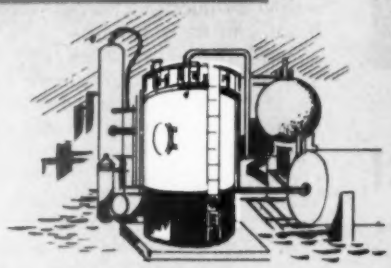
By efficiently removing salts, solids and other impurities, Petreco desalting enables refiners to run more crude. A survey of 62 Petreco customers shows that refinery charge rates were increased on an average of 21.3%; these gains being directly attributed to efficient desalting.

LUBE OIL TREATING



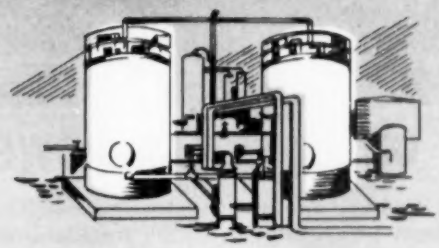
By offering a continuous, automatic lube oil acid-treating process, Petreco provides for substantial savings in acid consumption, ground space and time; it eliminates guesswork and insures against human error. Petreco treating insures minimum oil losses, maximum product quality.

DISTILLATE TREATING



Applicable to acid, alkali or doctor treating, the Petreco process takes guesswork out of distillate treating. It permits continuous, automatically controlled treating with minimum equipment, handling, and attention. Processing is in a closed, non air-polluting system.

DESAPONIFICATION



Petreco treating removes about 85% of the ash-forming constituents in fuel stocks which result from the addition of caustic to crude before distillation. This purification enables the fuel stock to be used as a cracking charge or marketed profitably.

For complete information on any or all of these Petreco profit-promoting processes, call or write to

PETROLITE CORPORATION—*Petreco Division*

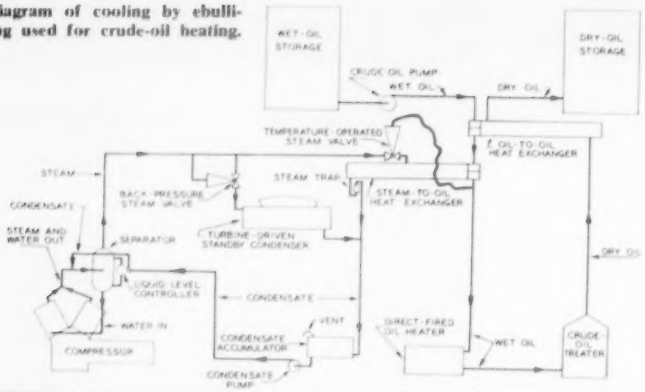
3202 SO. WAYSIDE DRIVE, HOUSTON 1, TEXAS

1390 E. BURNETT STREET, LONG BEACH 6, CALIFORNIA

PETRECO

ELECTRIC PETROLEUM PROCESSING

Fig. 1—Flow diagram of cooling by ebullition. Steam being used for crude-oil heating.



20 Water Main Taps Per Day
WITH ONE SHERMAN POWER DIGGER!

Because of the speed and ease with which trenches and holes can be dug by a Sherman Power Digger, Utility Installations Co. of Detroit has found a profitable sub-contracting business—digging to tap water mains and trenching for service lines into homes in new housing projects. Up to 20 bell holes for water main taps are dug by a single Sherman Power Digger in one working day. This performance is due to the easy handling of the all-hydraulic Sherman Power Digger—its flexibility, compactness and maneuverability. Combine these with Sherman's exclusive design features, simple maintenance and amazingly low initial cost . . . and you'll find that a Sherman Power Digger will fit into *your* operation profitably too! Write for free literature A11.

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Designed, Engineered and Manufactured Jointly by
SHERMAN PRODUCTS, Inc.
Royal Oak, Michigan
WAIN-ROY CORPORATION
Hubbardston, Mass.

Patent No. 2,303,825
Other patents pending

Sherman
PRODUCTS, INC.
ROYAL OAK, MICHIGAN

ON THE JOB . . . IN THE FIELDS

Engine cooling by ebullition

by R. P. Bland

THE cooling system for the compressor plant and heating-oil system for the dehydrator plant operated by Tide Water Associated Oil Co.'s production department at Ventura is described here.

The method of engine cooling described is the result of field studies by O. B. Freeman and the author (see the article by Freeman in The Oil and Gas Journal February 23, 1953).

Principle . . . To those not familiar with cooling by ebullition there are four conditions necessary:

1. Boiling heat transfer. Cooling by ebullition gives this by boiling the water in the cylinder jackets and cylinder heads, with its resultant even temperature of cylinder liners and heads.

2. Thermal circulation. This is the result of water boiling in the cylinder jackets and heads. The steam formed carries water that is many times its own weight up through cylinder jacket and heads into the separator.

3. Separation of steam and water. The separator is an important part of the system. It separates the steam from the water after leaving the engine. The water returns to the bottom of the cylinder jackets, thus completing the circulation through the engine. The steam goes to a condenser.

4. Steam condensing and condensate return. This could be listed as desirable rather than necessary. The steam after being separated from the water goes to some form of condenser, which might be a heat exchanger where the steam is used to heat something, or to an air-cooled condenser just to recover the condensate. If the condenser is set high enough the condensate can return by gravity; if condenser is low the condensate can be pumped back. The condensate should be returned in the line from engine to separator.

In the particular installation considered there were several conditions leading to adoption of the system shown in Fig. 1.

First factor was proxmity of the two plants. The dehydrator plant is located about 300 ft. from the compressor and

Author is assistant compressor-plant foreman (construction) for Tide Water Associated Oil Co., western division, Ventura, Calif.

higher than the compressor plant, requiring 400 ft. of steam line.

Second, gas was being burned to heat crude oil. The dehydrator plant was producing 6,042,000 B.t.u. per hour. This maintained a lower wet-oil temperature than desired.

Third, heat was being wasted by engine radiators. The 2,050 installed horsepower wasted 5,800,000 B.t.u. per hour through the radiators. This waste of heat so close to a plant that had a use for it plus the desire to cool the compressor plant by ebullition and raise the efficiency while lowering the operating cost in the compressor plant, led to the suggestion. The use of this waste heat was of particular interest to management.

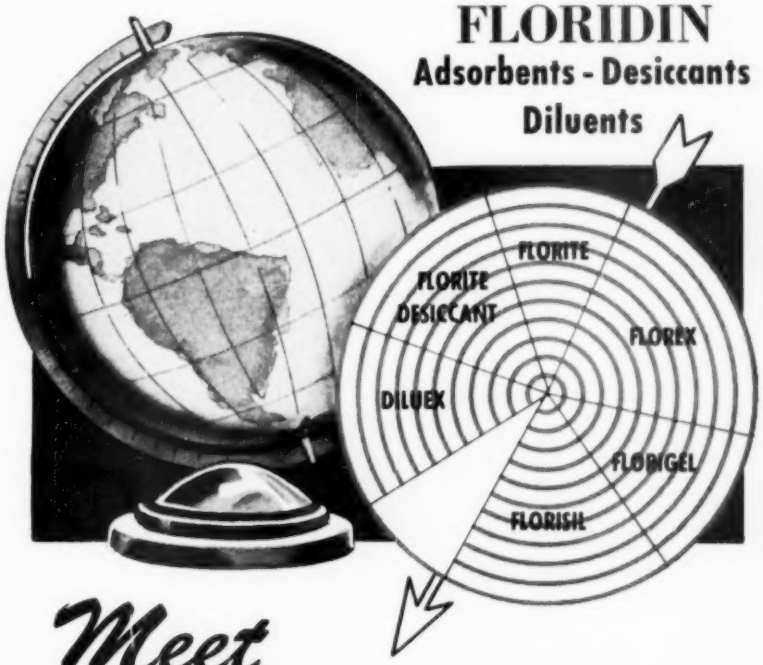
How it works . . . The drawing (Fig. 1) shows the complete flow plan of the suggestion. In this plan eight 1-R XVG compressors are cooled by ebullition. Each compressor engine has a separator, thus keeping the water lines the shortest possible length. This keeps the temperature rise across the engine to a minimum. The water-pipe sizes of XVG's were very small. This necessitated many changes in coolant-line design. The water leaves the bottom of the separator through a 2-in. pipe. This pipe extends all the way around the engine with 1-in. pipes to each power cylinder. This 2-in. line is the minimum size that can be used while holding the water velocity under 200 ft. per minute, since the compressor engines circulate about 1 lb. per minute per engine rated horsepower.

The small 1-in. copper tube from the cylinder head to the exhaust manifold was removed and a plate put over the hole on the head. A ½-in. pipe was run from the 2-in. inlet header to the bottom of the exhaust manifold. The existing 1¼-in. pipe from the top of the exhaust manifold was extended up to a new 3-in. head. A 1½-in. hole was drilled in each cylinder head cover plate and a flange made to fit.

The 1½-in. pipe from the top of the head goes to the 3-in. header. There are two 3-in. headers connected to the four cylinders on each half of the engine. The two 3-in. lines come together in a tee made from two 4 by 3-in. reducing elbows. From here the steam and water flows through a 4-in. pipe to the separator. These lines from the heads to the separator are sized to give a velocity of 2,500 to 3,000 ft. per minute, the desired velocity. This completes the coolant circuit from the separator to cylinders up through the heads and back to the separator.

The steam is taken from the top of each separator through a 3-in. pipe with a shutoff valve. This connects to an 8-in. steam line. The 8-in. steam line is large enough to add three more compressors and still be under 6,000-ft.-per-minute steam velocity. This gives less than 1 psi. pressure drop in the 400 ft. of steam line. At the dehydrator plant the steam is admitted to the heat exchanger through a temperature-operated motor valve that controls the temperature of the crude oil from the heat exchanger. The condensate is taken from the bottom of the heat exchanger through a steam trap and is gravitated through a 2-in. pipe to an accumulator. When the flow of oil is light there will be an excess of steam. This requires some standby condensers to handle the extra steam. This plant has 40 per cent standby condensing.

The amount of steam to the standby condenser is controlled by a pilot-operated back-pressure valve. This is set at 22 psig., the pressure at which the engines work. This gives steam at a temperature of 261° F. The standby condensers have turbine-driven fans. The speed at the turbines is controlled by the amount of steam being bypassed through them by back-pressure valve into the condensing coils. From here the condensate is gravitated to the accumu-



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lator. From the accumulator the condensate is pumped by a gas-powered pump, through a 2-in. pipe line and header in the compressor house. A ¾-in. pipe feeds the condensate into the line from the engine-coolant outlet manifold to the separator by a float control valve mounted on each separator. This completes the steam and condensate cycle.

The 50-lb. fuel gas is used to power the jet pump for handling the condensate. The gas from the pump discharges into the low-pressure fuel heater to the engines. By using a fuel-gas-powered pump the plant is completely independent of any outside factor such as electricity for the operation of the plant.

The accumulator has a float valve connected to the soft-water line. This is to replace the water lost when an engine is drained for maintenance work.

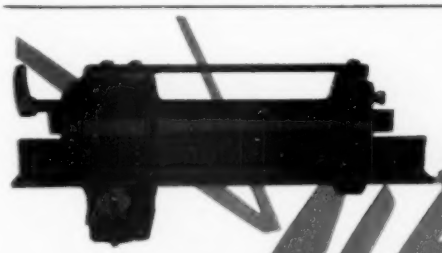
Each separator is equipped with a mercury-tube low-level switch that grounds the magnetos, thus killing that compressor in case of water loss for any reason. Each separator also has a safety pop set at 25 psig.

With regard to compressor-cylinder cooling, on each cylinder all water lines are removed. All holes are plugged except one on top; a swage nipple is installed here. A small overflow line runs from the side of the swage nipple to the drain. The cylinder is filled with oil, in this case with old crankcase drainings. There is no pump or any means to circulate the oil as it is not necessary. The nipple is left open for venting. The overflow line takes care of the expander oil when there is a hot valve. This is being used on compression ratio above 4 to 1.

Crude-oil heating system . . . This system at the dehydrator plant is also shown in the diagram. Pumps take oil from the wet-oil storage tanks, pumping it through an oil-to-oil heat exchanger. Hot dry oil from the treaters passes to one side and wet cold oil on the other side. The crude oil after being warmed in this heat exchanger goes to the steam-to-oil exchanger. This heat exchanger is the only change the suggestion makes in the dehydrator plant. The temperature of the oil from this exchanger is controlled at 160° F. by a temperature-operated motor valve on the steam line. At times, when part of the compressor plant is down or the flow of oil is extra heavy there will not be sufficient steam to bring the oil up to 160° F. For this reason the old direct-fired oil heaters are left in the line and will automatically control the temperature to 160° F. From here the oil goes to the treaters. From the treaters it goes to the first heat exchanger and then into the dry-oil storage tanks.

Savings . . . Cooling by ebullition makes for real economy of installation as well as operation. Freeman's paper in the February 23, 1953, issue gives more details on this. The cost to cool 2,050 hp. and heat 16,000 bbl. per day of crude oil in this case is $40,000.

Cooling by ebullition allows a 10 per cent increase in horsepower. This raises the 2,050 installed horsepower to 2,250. This 2,250 hp. will deliver 6,670 lb. of steam per hour, or 6,240,000 B.t.u. per hour to the heat exchanger with insulated steam lines. With the flow rate, 16,000 bbl. per day of 25 per cent water, 32° A.P.I. crude oil, 6,670 lb. per hour of 261° F. steam will give a temperature rise of 47° F. This steam saves $5,000 a year in fuel gas at the dehydrator plant. Cooling by ebullition increases the life and efficiency of the engines, making a large saving in operation and maintenance in the compressor plant. This saving with the saving of operating the fan, radiator, water pump, and the auxiliary engine driving the fan and water pump



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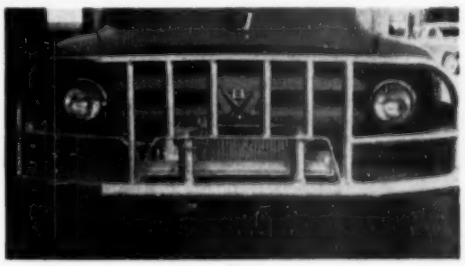

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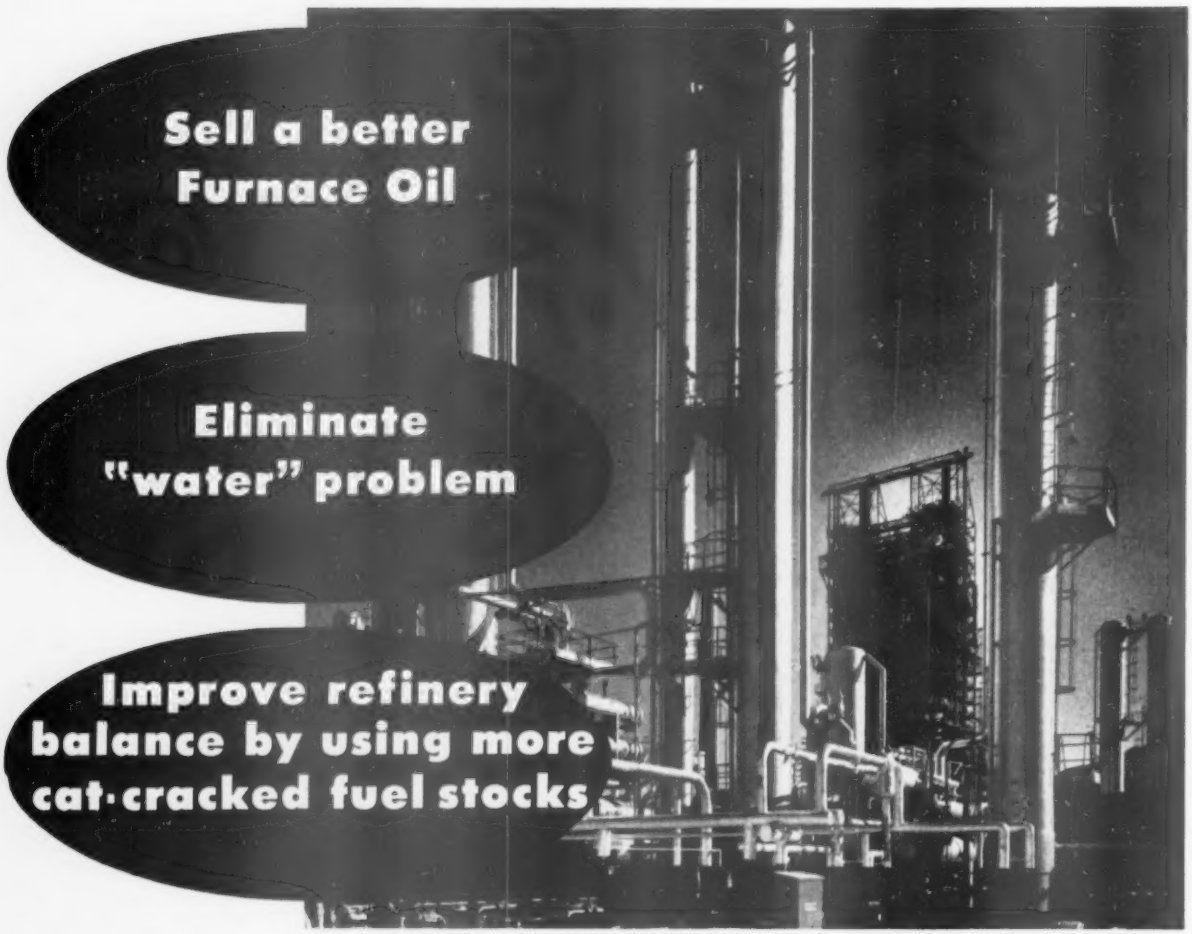

Dispersant FO is a new anti-gumming, rust-inhibiting additive that greatly reduces, even eliminates, deposits and screen clogging in home heating units and storage tanks. Your product with FO will offer dealers many competitive advantages and greatly reduce their number of costly service calls due to clogged filter screens and nozzles.

"Water" is always *the big problem* for the distributor, dealer and home user. The active ingredient in FO is an entirely new chemical, developed especially for use in furnace oils. NEW DISPERSANT FO DOES NOT EMULSIFY WATER WITH BURNER OIL. It will settle the water out of burner oils in short order to provide a "dry" fuel.

Furnace oil with FO has exceptional rust-proofing properties. Steel and iron surfaces in contact with the oil are made corrosion resistant. The "water layer" of the tanks and lines get protection too. A portion of Dispersant FO is water extractable, affording rust and corrosion protection to that portion of the tank not in direct contact with the oil.

This new additive improves stability and permits the blending of higher percentages of cat-cracked stocks without additional gum formation. It improves refinery balance, and you can cut costs by reducing the severity of acid treating of your cat-cracked heating stocks.

The stabilizing action and rust-inhibiting quality of Dispersant FO are obtained at very low dosages. Usually added in the ratio of 1 pint per 1000 gallons of oil stock, at any temperature, prior to shipment by tanker, pipe line or truck.

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amounts to another $5,000 per year.

The elimination of the auxiliary engines, fans, radiators, and water pumps reduces the work load on the plant operator and oiler to a large extent.

With an installation cost of $40,000 and an annual saving of $10,000, the payoff is 4 years.

Wrench lessens load on pipe-line gager

BY using a long, snugly fitting wrench fabricated of scrap ¾-in. sucker rods, one pipe-line company has lessened the load imposed on the gager in opening and closing plug valves. The wrench is made by a 5-ft. length of the rod near the center so that two square corners are formed to fit over

the square on the end of the plug. The short end after bending is tack-welded to the longer end, and a very short piece of the rod is welded into the loop to box in the wrench end.

Mud tank with unitized manifold

ON drilling operations requiring only a single mud pump, Santa Fe Drilling Co. uses a mud tank having its manifold integral with the tank and fittings. The arrangement is such that the pump takes suction directly in a straight line from the end of the tank. High pressure is discharged through an overhead line directly from the pump to the manifold, with a relief line from a shear-pin safety valve installed immediately above.

Piping for the manifold incorporating lubricated plug valves is arranged so any one of several lines can be used to deliver the mud to the point of use. Two takeoffs are provided for mud lines to two separate derrick standpipes having block valves to control flow as desired. Piping is connected to the manifold with Unibolt unions placed so the outside pipe can be disconnected without leaving projecting pipe stubs to interfere when lifting the tank, shipping by truck, or laying down for rigging up.

The manifold is connected to the tank at four points with saddles and keepers having bolts to retain the assembly in the desired position. Quick removal of the manifold from the mud tank when making repairs or replacements is the main feature of the arrangement.

Trailer compressor and generator with well-pulling unit

ONE of the larger operators in California's San Joaquin Valley has developed a portable compressor-generator trailer to be used by a well-pulling unit and to be transported with the unit. The trailer provides electric power for lighting and other purposes, air for controls or tools, and water for cooling the pulling unit's brakes.

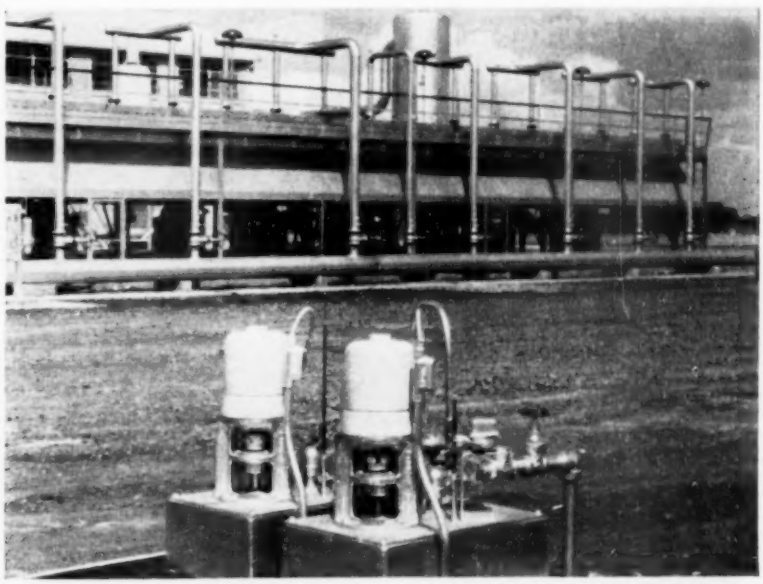

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Photo shows two Deming vertical sump pumps in gas pipe line booster station service. High efficiency and dependable operation of these pumps are insured by their heavy duty construction, close tolerance dowel-ring fits from motor to impeller, positive alignment of all rotating and guide-bearing parts and other modern developments.

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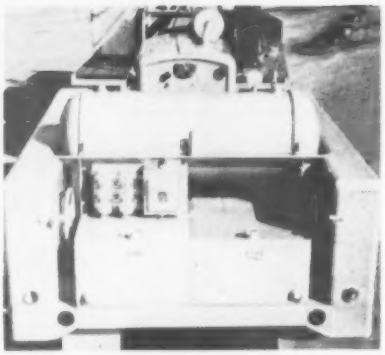


As may be seen in the photograph, the trailer also has an emergency compartment for diesel fuel.

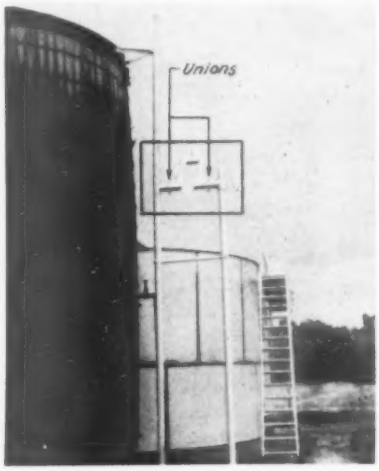
Power for driving the 15-kw. Palmer generator, and the Worthington (15c-2) two-stage compressor is provided by a General Motors 35-hp. diesel engine through multi-V belts.

On either side of the trailer are storage compartments, one for water hose and the other for electric cord. The hose and cord are wound on reels, and exterior-mounted hand wheels facilitate winding.

Also mounted on the four-wheel tandem trailer are several compartments for the storage of valves, regulators, gages, fittings, tools, and waste.

Controlling water level in wash tank

CONTROL of water level in the wash tank of a Gulf Coast tank battery is accomplished without the use of a splash box and movable leg on the siphon. In this hookup, shown in the photograph, the two risers common to any siphon are fixed in position—vertical and parallel. The risers are connected at the correct height by a U-bend, two unions, and a short nipple attached to each of the risers. The nipples are placed about 2 ft. below



the oil outlet to the stock tanks. When connected as shown, only the return bend needs to be moved to change the water level in the tank. The return bend is vented by a ¼-in. fitting.

Mud heater installed on substructure

SMALL items, when intelligently designed and operated, can contribute to efficient rigging up on rotary drilling wells. For example, the hydraulic mud line from pumps to the derrick standpipe is usually laid on the ground, or cribbing, so it must be relaid each time a well is rigged up. To overcome some of the elapsed time in this phase, the mud header can be mounted on brackets attached to the substructure, particularly if the derrick can be skidded from one location to another.

The header is made from a joint of

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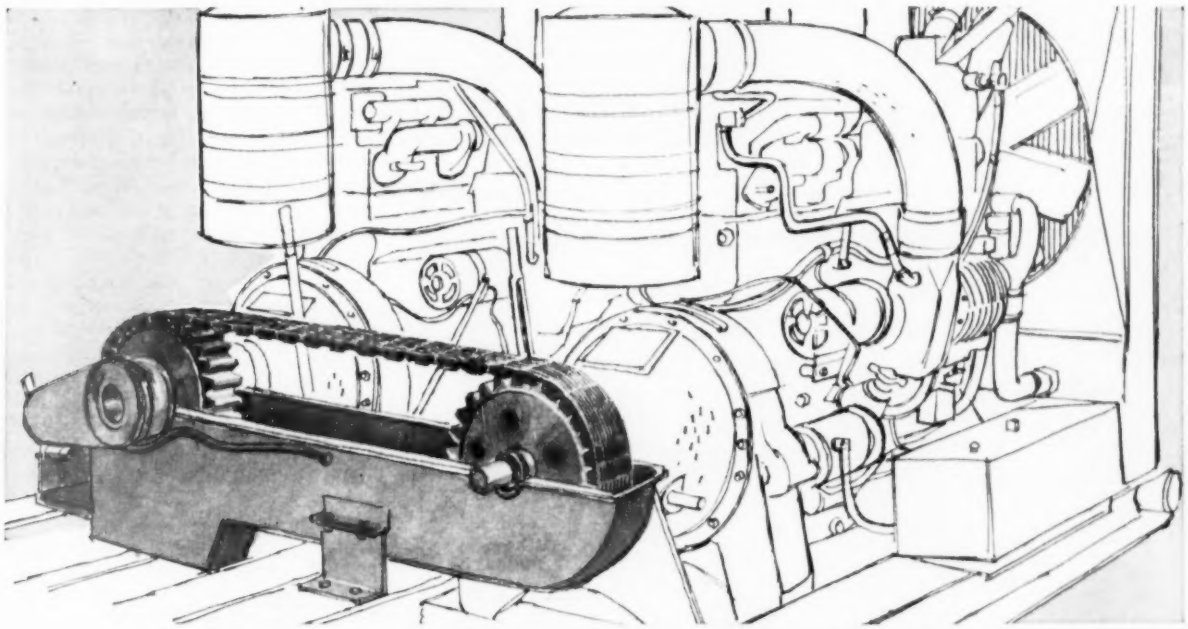

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Now, gain new advantages in buying and compounding smaller, higher speed engines with Morse Hy-Vo Drive.

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The total cost of two high-speed engines and the Hy-Vo Drives with which they are compounded will usually be considerably less than a single large engine of equivalent horsepower. A brief look at some figures will show how this works . . .

For example, if you needed 250 continuous horsepower at 1200 rpm., you could: 1) Buy a manufacturer's 250 hp., 1200 rpm. engine, which lists for $13,330; 2) buy the 250 hp., 1800 rpm. engine for $11,930 (using Hy-Vo as a connection and reduction drive, also eliminates the costly flexible coupling normally required in choice No. 1); 3) or, use two 130 hp., 1800 rpm. engines, listing for a total of $8,820, and use Hy-Vo as your compounding drive.

With the 250 hp., 1800 rpm. engine, you save $1,450, more than enough to pay for your Hy-Vo Drive. Compounding two 130 hp., 1800 rpm. engines, you save $4,560 over base list cost of the 250 hp., 1200 rpm. engine.

From this saving you could pay for your Hy-Vo Drive and bank several thousand dollars. In most cases, too, Hy-Vo will be so narrow it will eliminate costs of outboard bearings and mountings, with the bonus that single-engine operation is possible under reduced power requirement.

Other power transmission methods generally have either inherent restrictions on rotative speeds and velocities that limit 200 hp. or larger engines to 1200 rpm., or are too costly. Hy-Vo has far greater upper limits, with relatively lower cost.

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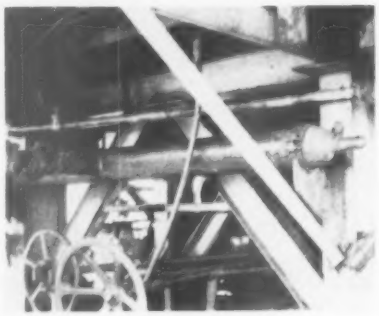
hydraulic pipe with fittings on one end leading to the standpipe, or pipes if more than one is used, while the opposite end is fitted with a bull plug so that a separate line can be attached if desired without cutting the pipe or making special connections. The discharge from the pumps enters the side of the header through adequate fittings supplied with single bolt unions.

If the derrick is equipped with double substructure, the header can be attached to the standpipe side and left in a permanent position, even if the rig is torn down each time a well is completed.



Wire-line spool has permanent hanger

A PERMANENT hanger for the drilling-cable wire-line spool has been developed by P. J. Thayer, tool pusher for Santa Fe Drilling Co.

The spool support frame is made of two pieces of 4-in. pipe attached to the bottom sill of the substructure with heavy clevis-type hinges. Spaced at a distance required for a standard wire-line spool, the outer ends of the 4-in. pipes are connected with 2-in. pipe between to maintain desired alignment. Loops welded to the outer ends of the frame provide means of connecting a piece of discarded rotary chain, the other ends of which are hooked to turnbuckles. Other loops welded to the vertical studding, or to the top sill of the substructure, are used for attaching the upper ends of the pair of turnbuckles.

To load the hanger with a new spool of wire line, the frame is lifted to move the side member above horizontal, and just high enough that the spool can be rolled against the substructure. Let down again, the frame is disconnected from the turnbuckles so the spool supporting bar—a piece of 4-in. pipe can be inserted and placed on shallow saddles attached on each side member of the frame. A step jack, placed beneath the 2-in.-pipe crossbar, is used to raise the load to the point where the chains can be hooked into the turnbuckles. Removing the jack allows the hanger to assume its normal loaded position so the spool of wire line can be unreeled on the hoisting drum of the drilling rig.

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EQUIPMENT MEN
. . . in the News

Cole Shifts Gavin and Folger for Orbit Valve

John J. Gavin has been appointed eastern representative for Orbit Valve Co. with headquarters at Pittsburgh,

J. J. GAVIN

C. J. FOLGER

according to R. G. Cole, general sales manager. Gavin replaces Charles J. Folger, who has been transferred from Newark, Ohio, to the Tulsa office of Orbit Valve to work on refinery and petrochemical sales.

Gavin has had wide experience in valve sales engineering. He is a graduate mechanical engineer from Carnegie Tech, and also holds a B.A. degree from University of Pittsburgh.

Folger is a graduate chemical engineer with a degree from Case Institute at Cleveland. Before joining Orbit in 1952, Folger was associated with Owens-Corning Fiberglas Corp. in the technical-development branch.

Santa Fe Promotes L. R. Obert to Vice President

An association of 35 years with Santa Fe Tank & Tower Co., Inc., has resulted in the promotion of Lawrence R. Obert to vice president and general manager. Obert joined Santa Fe as an engineer in 1919. Since then, he has helped to elevate the company to a leading position in the field of industrial wood products; cooling towers, wood tanks, wood pipe, and cross arms.

Obert will coordinate sales and service activities of Santa Fe's factories and branch offices located in all principal cities.

National Pipe Coatings Names Campbell to New Post

The appointment of R. W. (Doc) Campbell as general sales manager of National Pipe Coatings, Huntington Park, Calif., manufacturers of Duratex

Al Capp to Do Ad Series for Johnston Testers

Al Capp (right), creator of one of America's most popular comic strips, "Li'l Abner," is shown here with execuitves of Johnston Testers, Inc., Houston, for which firm he is doing a series of cartoon advertisements. These ads will appear monthly in oil-industry publications starting April 1. The series will feature "Available" and "Accurate" Johnston, new characters created for Johnston Testers by Capp. Shown here with Capp are J. E. Smith, vice president in charge of sales, and Tom Johnston, executive vice president of Johnston Testers.

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The INFERNO Firing Control saves you money on labor by releasing the fireman for other duties around the rig.

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• NO-GALL, with more than 50% pure metallic zinc, increases thread life by providing real thread protection.

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pipe-line enamels, has been announced by Raleigh P. Nelson, president. Campbell has been widely known in the gas industry on the Pacific Coast for the past 30 years. He received his engineering degree at Purdue University.

Nordberg Names McCarthy As Sales Engineer

R. H. McCARTHY

Appointment of Richard H. (Dick) McCarthy as sales engineer has been announced by R. W. Bayerlein, vice president, heavy-machinery division, Nordberg Manufacturing Co.

McCarthy will headquarter at Nordberg's branch office at Dallas, serving large, heavy-duty engine users in North and Central Texas, Oklahoma, and New Mexico.

McCarthy received his initial diesel-engine training at the U. S. Navy's Basic Engineering and Diesel School. After a year's assignment in the Philippine Islands, McCarthy returned to civilian status and received his degree in mechanical engineering at Oklahoma A. & M.

In 1951, McCarthy joined Nordberg at Milwaukee, where he progressed through production, engineering, and service departments, qualifying for assignment to the sales department in June 1953.

Mud Distributors Form Oklahoma Association

Oklahoma oil-field-mud distributors, representing the national and independent mud manufacturers, have organized a trade association which will be known as the Oklahoma Mud Dealers' Association. Clinton Lambert, Yale, Okla., manager of Kermit W. Ingham Lumber Co., was elected president of the new association.

J. Fred Hill, vice president of National Mud Co., Oklahoma City, was elected vice president, and K. P. Larson, owner and manager of Monarch Mud Co., Duncan, Okla., was elected secretary-treasurer.

The trade association was formed to unite all dealers and distributors of oil-field mud and chemicals in the Oklahoma and surrounding areas. The association is a nonprofit organization whose purpose is to promote the interest of all the members, interchange of information among them, and repre-

LIQUID MATERIALS HANDLING
BLACKMER
PUMPS
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50th Year

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Blackmer's growth has been earned by the development and manufacture of products backed by 50 years of constant laboratory and field research. These products include industrial bulk pumps, truck pumps, hand pumps, strainers and fluid motors. Blackmer's advanced design, smooth operation, economy, and flexibility of use . . . have been performance proved throughout the last half century. Wherever liquids are handled, Blackmer pumps are known for quality, dependability and record durability. And now, new products soon to be announced promise a new standard of performance. Our engineers can solve your liquid materials handling problems . . . write for details today!

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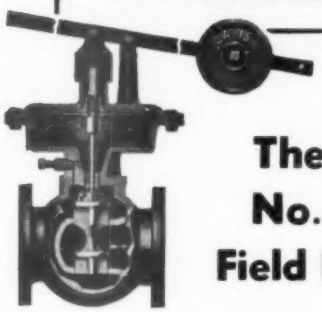
GRAND RAPIDS • DALLAS • WASHINGTON • SAN FRANCISCO
See Yellow pages for your local sales representative

WEATHERPROOF!



The DAVIS No. 330W Field Regulator

1. SIMPLE, DEPENDABLE, AUTOMATIC! Widely used in gas-gathering systems everywhere, indoors or outdoors. Exclusive rain cap protects diaphragm.
2. VERSATILE! Use for either back pressure or vacuum merely by reversing counterweight—no extra parts to add.
3. SENSITIVE! Thanks to large diaphragm, weight loading, balanced valve. Built-in by-pass steadies action, prevents pulsation.
4. QUALITY CONSTRUCTION! Offered with all stainless steel trim, renewable seat rings. Close coupled; no packing to maintain. Sizes 2" to 12". ASK FOR BULLETIN G-1.

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DAVIS REGULATOR COMPANY

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AN OLDTIME RECIPE FOR LONG-LIVED PIPE LINES

A recipe that waterworks and gas distribution engineers have used for over a century is: *specify cast iron pipe.* Refinery engineers have used it, too—with good success—for run-down, water and gasoline lines—for fire protection systems—salt water disposal—condenser and cooling coils.

No other pipe, at reasonable first cost, offers comparable resistance to both interior and exterior corrosion. No other pipe, in its price range, is as economical in the end. Available with bell-and-spigot, plain end and flanged, or with standardized mechanical joints. Cast Iron Pipe Research Association, Thomas F. Wolfe, Engineer, 1015 Peoples Gas Bldg., Chicago 3, Illinois.

CAST IRON PIPE
FOR LONG LIFE AND ECONOMY

NEW "SNAP-ON" ONE PIECE PIPE INSULATION

BALDWIN-HILL MONO-KOVER

Baldwin-Hill MONO-KOVER is a flexible, featherweight pipe insulation easily applied by spreading at the seam, snapping around pipe and fastening with staples, bands or other fasteners. It is incombustible and moisture-proof—composed of fine mineral wool fibers bonded with phenolic resin and molded in one piece sections.

- Extra Light Density
- Easily Cut and Fitted
- Six Foot Lengths
- Resilient, Flexible
- Won't Break or Crumble
- Easy to Paint
- Highly Efficient
- No Coarse Fibers
- Takes Rough Handling
- Effective Up To 350° F.
- Easily Nested
- Non-Corrosive
- Won't Rot, Decay, Mold
- Lower Applied Cost

Write For Complete Information

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Kalamazoo, Michigan . . . Huntington, Indiana . . . Temple, Texas

sentation in dealings with government regulatory bodies and with oil-field-mud manufacturers.

Armour Chemical Names La Susa to Petroleum Post

C. D. La Susa has been appointed to the newly created position of petroleum technical service for Armour Chemical Division's fat-derived products now used extensively in various phases of petroleum operations. La Susa's primary responsibility will be to assist primary and secondary oil producers, refiners, and processers in solving problems such as corrosion and bacteria-algae growth, common to the industry.

A graduate of Northwestern University, La Susa joined Armour in 1950 as chemical sales representative in the St. Louis territory. In his new position he will make his headquarters in the division's home office in Chicago.

Moorlane Names Smith As Amarillo Branch Manager

I. L. SMITH

Irvin L. Smith has been appointed manager of the Amarillo, Tex., branch of Moorlane Co.

The Amarillo branch of Moorlane, in its own warehouse, stocks a complete line of pipe, valves, fittings, and other piping materials. This branch was established in 1941, and was managed by H. E. Boggs who recently resigned from the company.

Smith has been office supervisor of the Moorlane branch since April 1951. Previously, he had been in the materials department of Jones & Laughlin Supply Division, Artesia, N. M.

Ansul Announces Schedule For Fire Fighting School

Eleven industrial fire-training schools, the first starting May 24 and the last starting September 20, will be held during 1954 on the fire test field of Ansul Chemical Co. at Marinette, Wis.

Each school will last 3 days, the starting dates being May 24; June 14,

WE TOOK THE "Bugs" OUT OF DESALTING EQUIPMENT

Custom built electrostatic units engineered by Howe-Baker have the "bugs" removed before each design leaves the drawing board. That's why refiners using Howe-Baker installations on three continents are getting trouble-free operation in treating over 1,000,000 barrels of crude oil per day.

SPECIALISTS IN PETROLEUM EMULSIONS

THE HOWE BAKER CORP.

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You are Cordially Invited

TO REVIEW YOUR PROGRAM WITH OUR OIL AND GAS DIVISION

THE CITY NATIONAL BANK OF HOUSTON

CAPITAL AND SURPLUS 15 MILLION DOLLARS

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21, 28; July 19, 26; August 16, 23, 30; and September 13, 20.

The school is held for the purpose of training fire marshals, safety directors, and fire-brigade leaders in the latest techniques of extinguishing fires with dry chemicals.

Last year, 225 persons attended 9 schools. Registration is limited to 25 men for each school, with reservations accepted on a first-come, first-served basis. Ansul provides all instruction and use of equipment free of charge, the students paying only for their transportation and living expenses while at Marinette. Address inquiries to: Customer Training Fire School, Ansul Chemical Co., Marinette, Wis.

Kone Is New Hammel-Dahl Sales Representative

Hammel - Dahl Co., Providence, R. I., manufacturers of automatic control equipment, announced the appointment of James S. Kone & Co., Amarillo, Tex., as new sales representatives.

Kone will represent Hammel - Dahl in Texas, Oklahoma, and Kansas. The company has been operating for the past several years under the supervision of James S. Kone, and has grown into an aggressive organization consisting of several experienced sales engineers, capable of solving automatic control problems.

Dynamatic Names Baylor As Oil-Field Distributor

The Dynamatic Corp., Kenosha, Wis., has announced the appointment of The Baylor Co., Inc., Houston, as exclusive representative for Dynamatic oil-field products throughout the country.

Sales and service will be conducted by many of the original personnel from branches located in Houston, Odessa, Tex.; Casper, Wyo.; and New Iberia, La.

Oilwell Announces Shifts In Rocky Mountain Area

The appointments of two more store managers, three field representatives, and a city representative in the Rocky Mountain area of U. S. Steel's Oil Well Supply Division have been announced by R. L. Armstrong, area manager.

Named manager of Oilwell's branch store at Worland, Wyo., was Arlie E.

IT'S FAST... IT'S NEW...

another CATAWISSA FIRST!

NEW SPEED FOR PIPING INSTALLATIONS

280% FASTER OPENING AND CLOSING

CATAWISSA DOUBLE START PERFECT SEAL UNIONS

WILL NOT LOOSEN UNDER VIBRATION

1¼ TURNS OF THE NUT TO MAKE UP!

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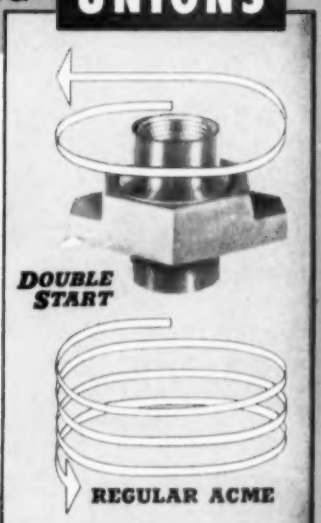
3½ turns of regular nut threads

ACME THREAD



2 START POSITIONS

NOW YOU CAN HAVE THE NEW SPEED OF DOUBLE-START THREADS IN ANY 2" TO 4" ACME THREAD CATAWISSA PERFECT SEAL UNION!

PERFECT SEAL SEATS

Catawissa now offers you the PLUS FEATURE of 280% faster nut opening and closing for all piping installations where you use Acme thread unions!

Customary fumbling for starting thread is virtually eliminated—Catawissa DOUBLE-START UNIONS have TWO Acme thread starting positions (instead of one) with the same holding qualities, the same ability to hold tight under vibration as regular Acme thread unions—the threads are Acme, the thread form is the same.

See them at your favorite supply store, place your order now—just specify DOUBLE-START THREADS on any 2" to 4" Acme thread Catawissa PERFECT SEAL UNION of the lug or hex nut type! (Smaller sizes on special order).

NO LOSS IN HOLDING QUALITIES

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WRITE FOR DATA SHEET D-S-1

CATAWISSA VALVE & FITTINGS CO.

450 MILL STREET ★ CATAWISSA, PENNA.

Don't buy
a pump . . .

buy a
Marlow

sold and
serviced
throughout
the world!

MARLOW PUMPS • RIDGEWOOD, NEW JERSEY

House. House's service has been in Oklahoma since he joined the supply division in July 1946. He was located successively at Oklahoma City, Pauls Valley, and Duncan before his move to Worland.

Frank J. Long was named manager of the Fort Morgan, Colo., store. The new manager was employed by Oilwell in 1949, and prior to his new appointment, served as field representative at Glendive, Mont., and Williston, N. D.

George H. Fletcher has been appointed field representative at the same location. Before transferring to Fort Morgan he held a similar post at Casper, Wyo.

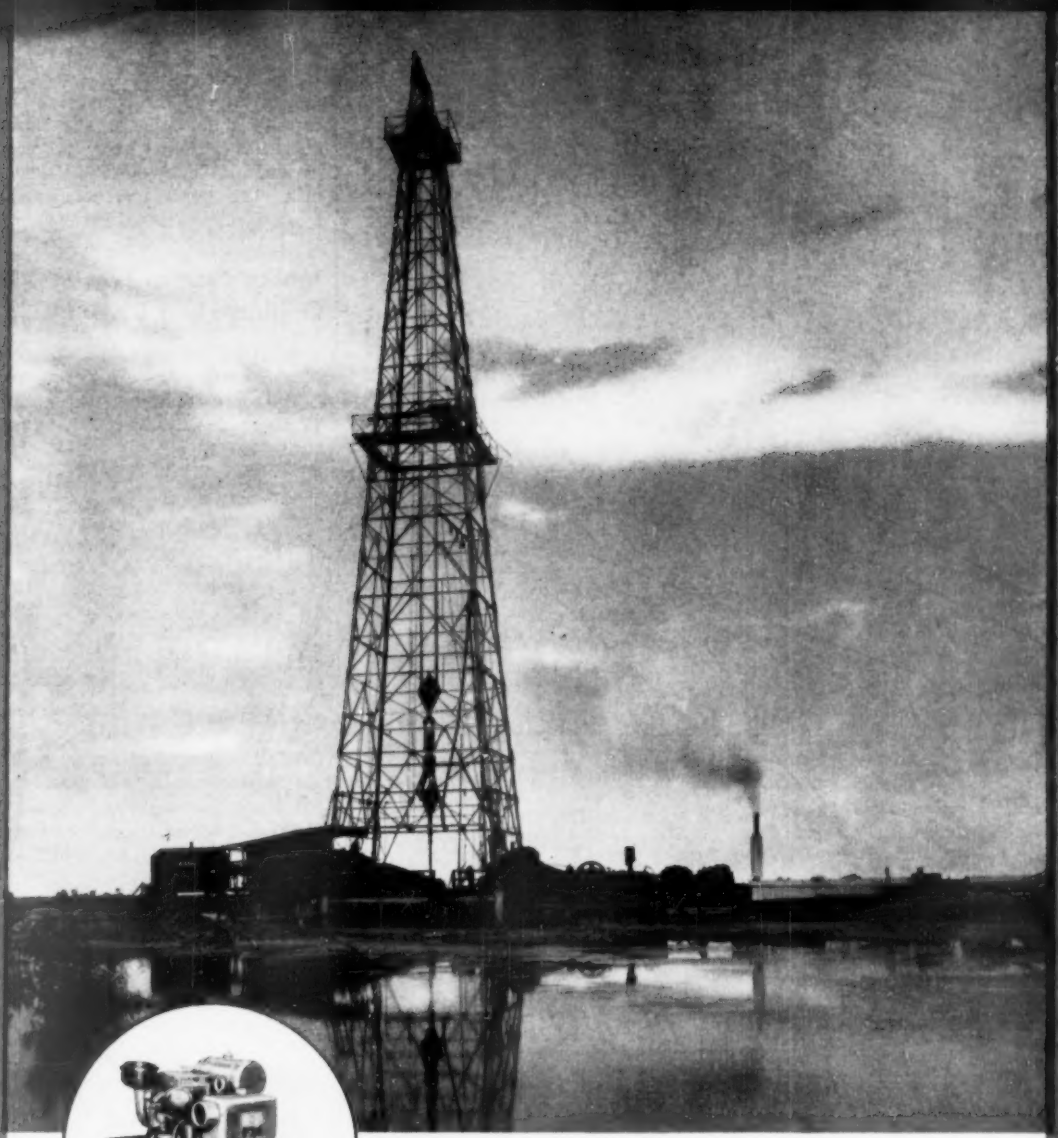
Donnie E. Bowers, who has been with Oilwell since 1952 at Powell, Wyo., becomes field representative at Glendive.

R. W. Anderson, employe of the Casper branch store since January 1952, has been named field representative at that city.

Paul H. Roberts has been employed

Mission Manufacturing Holds Division Sales Meetings

Mission Manufacturing Co. has recently held divisional sales meetings in Odessa, Oklahoma City, Baton Rouge, and at Camp Mission at Aransas Pass, Tex., for its salesmen in the field. Divisional meetings were held this year instead of the general sales meeting formerly held in Houston, in order to be in closer touch with field conditions. W. T. Campbell, executive vice president of Mission, and T. R. Fullinwider, assistant to the domestic sales manager, conducted the meetings. Pictured at Aransas Pass (No. 1) are: W. C. Underwood, Houston; G. B. Wyatt, Houston; F. J. Hebert, Corpus Christi; F. S. Mims, Houston; J. S. Stewart, Houston; Jack Bannister, Old Ocean, Tex.; and Tony Volotko, Houston. At Odessa (No. 2) are: standing, L. L. Roberson, Bakersfield, Calif.; R. E. Hardy, Abilene, Tex.; Fullinwider; and E. D. Hallum, Odessa. Seated are: L. M. Roberson, Long Beach, Calif.; O. K. Ryan, Lubbock, Tex.; John Bannister, Hobbs, N. M.; and Campbell. At Baton Rouge (No. 3) are: standing, A. E. Higginbotham, Baton Rouge; Campbell; and Fullinwider. Seated are: C. L. Turner, Shreveport; and Joe Scalise, New Iberia, La. At Oklahoma City (No. 4) are: standing, Fullinwider; R. M. Wood, Mount Carmel, Ill.; G. G. Boyd, Edmonton, Alta., Canada; C. W. Fryar, Wichita Falls; M. C. Davis, Denver; and Campbell. Seated are: George DeArman, Casper, Wyo.; J. E. Young, Oklahoma City; E. L. Brown, Marlow, Okla.; and J. H. Brown, Great Bend, Kans.

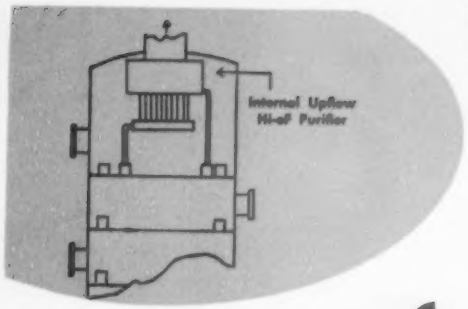


Dawn to dusk or 'round the clock duty doesn't bother tool pushers who need dependable pumping. They're finding Marlow Self-Primers and Marlow "Mud Hog" Diaphragm Pumps are an important part of their job. For pumping wastes from cellars, or for washing down rigs, brake cooling service, and utility water supply, Marlows can't be beat!

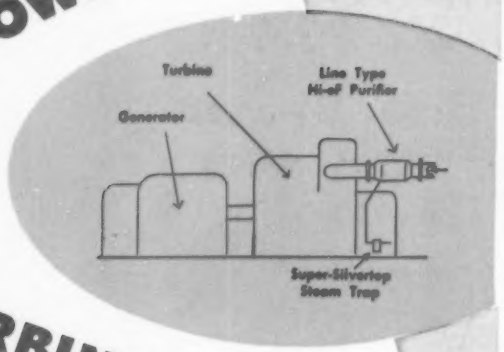
marlows are durable!

Marlows are "old hands" at oil country pumping. They're built to handle the tough jobs in the field efficiently, day in and day out, with little attention and low maintenance. Known for their rugged dependability by majors and independents alike, more and more veteran oil men are making Marlows their *first choice!* Make sure with Marlow . . . get *all* the facts from your Marlow Dealer or write for Bulletin O-53.

MARLOW PUMPS • RIDGEWOOD, NEW JERSEY



FROM TOWERS



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as city representative at Casper. He comes to Oilwell with considerable experience in the oil-field-supply business. The new representative will be located at the area office in Casper.

Macco Names Two Men to Drilling Fluid Division

Macco Drilling Fluid Division, Macco Corp., has appointed two new sales representatives. Jerry Stafford, Ventura, Calif., district representative

J. STAFFORD

REX JONES

for Sperry Sun Well Surveying Co. for the past 4 years, will now represent Macco in the same area. Prior to his California connections, Stafford was employed in the Tulsa office of Loffland Brothers Co.

Rex Jones, formerly a representative for H. C. Smith Oil Tool Co. in the Santa Maria, Fillmore, and Castiac, Calif., areas, has been assigned by Macco to represent the Drilling Fluid Division in the Bakersfield, Calif., area.

Metal Goods Names FitzRoy To Industrial Post

R. E. Grote, Jr., vice president and sales director of Metal Goods Corp., has announced the appointment of Donald A. FitzRoy to manager of its Industrial Products Division.

D. A. FITZROY

FitzRoy, who was formerly assistant manager of the Industrial Products Division, joined Metal Goods in 1949 as a general line salesman. Previously, he was associated with Air Reduction Co. for a number of years.

In his new assignment, FitzRoy will handle fastenings, fittings, valves, brazing alloys, castings, and other industrial metal accessories.

Metal Goods Corp. has general offices in St. Louis, with district offices and warehouses in St. Louis, Kansas City, Dallas, Houston, Denver, Tulsa, and New Orleans.

Sales Coordinator Named For Wedgeplug Valve

The Wedgeplug Valve Co., Inc., New Orleans, has announced that Daniel C. Vernon, Los Angeles, has joined the Wedgeplug organization as sales coordinator.

Wedgeplug is an affiliate of Stockham Valves & Fittings, Birmingham, Ala., and Wedgeplug valves are sold through the same jobber distribution setup as Stockham valves and fittings. Vernon's job will be to coordinate the sale of Wedgeplug valves wth Stockham products.

Vernon is a graduate of University of Alabama. His background includes 3 years with Tennessee Coal, Iron & Railroad Co., and 2 years with Huntsville Arsenal. He joined the Stockham organization in 1946 as a mechanical engineer. In 1949 he was transferred to the sales department, in Southern California, with headquarters in Los Angeles.

McCullough Names Swafford To Lake Charles Branch

W. E. SWAFFORD

W. E. Swafford has been appointed sales engineer at the Lake Charles, La., branch of McCullough Tool Co., according to an announcement by O. J. McCullough, vice president.

Swafford attended Midwestern University, Wichita Falls, Tex., followed by oil-field experience with Reed Roller Bit Co. at Oklahoma City, and Columbian Fuel Corp. at Liberal, Kans.

Previous to his new appointment, Swafford had been working as an operating engineer out of McCullough's New Iberia, La., branch.

Danielson Joins Hill & Christopher Agency

Robert E. Danielson has joined Hill & Christopher agency, Los Angeles, for account and copy work on the Halliburton Oil Well Cementing Co. account. Danielson, former vice president of Western Press, Inc., St. Louis, succeeds William R. Graydon, who has been appointed West Coast editor of a petroleum magazine.

Trap Users Everywhere Are Excited About

NEW

HEAT-KWIK

Super-Silvertop

STEAM TRAPS

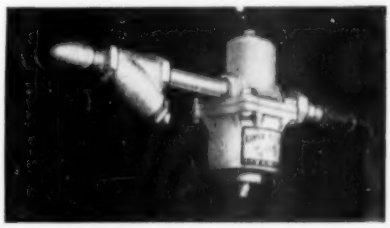
...world's fastest venting inverted bucket steam trap

Save Hundreds of Dollars...
You save production time by venting air out of steam consuming units 8 times faster than possible with ordinary inverted bucket traps.

Save on Fuel...
Purges air all at once so that unvented air cannot mix with steam entering steam compartment, thereby reducing the temperature and acting as heat insulator.

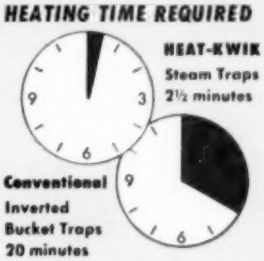
Use Smaller Traps...
Only necessary to use a 1½ trap factor in most instances, never more than 2. This means smaller sized traps can be used.

Save on Trap Repairs...
Bellows orifice does not contract continually, like in thermostatic trap, but remains closed until it cools off. This means long bellows life.



FREE NEW Heat-Kwik Bulletin. Mail Coupon Below.

HEATING TIME REQUIRED



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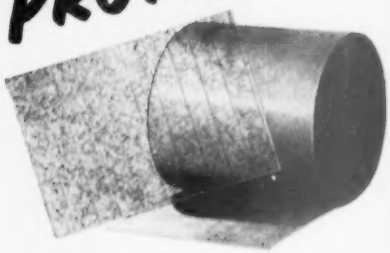
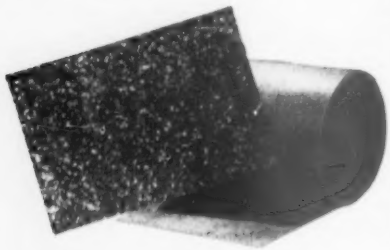


BLUE FLAG *Glass Fiber Reinforced PIPE WRAP*

Pulls into hot coatings, minimizes holidays and provides permanent high strength reinforcing that's unaffected by moisture and soil acids.



Duramat *Glass Fiber Reinforced OUTER WRAP*

Made from an asphalt and tar compound, reinforced with glass fiber mat and yarn—provides a tough "hide" to protect coatings against handling, backfill and soil stress.

Write for information on protection for your pipelines. Glass Fibers Inc., 1810 Madison Avenue, Toledo 2, Ohio.

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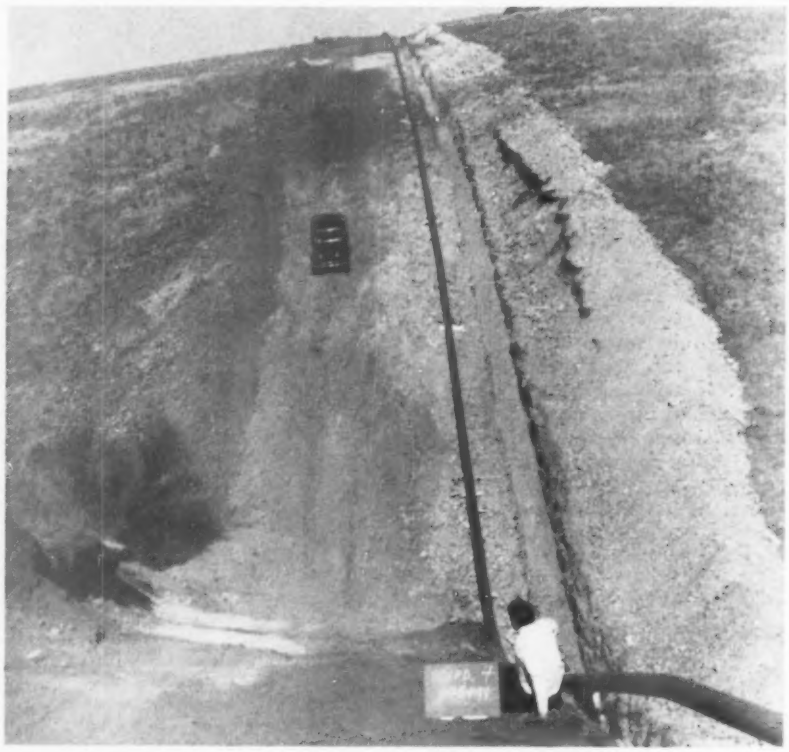
Pipe-Line Patrol

. . . Report on Construction



Yellowstone Line One-Third Complete

CONSTRUCTION work on the 10-in. Yellowstone Pipe Line Co. products line from Billings, Mont., to Spokane, Wash., is approximately one-third complete. Between 150 and 200 miles of pipe have now been laid, and completion is scheduled for September. Shown above is a construction photograph taken at Missoula, Mont., by Eastern Pipeline Contractors. This firm has the contract for the line around Missoula. On completion, the line will transport initially 30,000 bbl. daily from the Billings refining area to Spokane. Ownership of the line is shared by Continental Pipe Line Co., Interstate Oil Pipe Line Co., Union Oil Co. of California, and H. Earl Clack interests.

Under Way, Contracted, and Planned . . .

PIPE-LINE activity as reported below by The Oil and Gas Journal is compiled from information received from pipe-line companies and contracting firms.

These projects include those planned, proposed, under way, and contracted. Uncontracted projects are indicated by a • preceding the company name.

Crude-Oil Pipe Lines

• **California - Oregon Pipe Line System**—103 miles 6-in., proposed, Crescent City, Calif., to Medford, Ore.

• **Cities Service Pipe Line Co.**—60 miles, 12-in., begin March 1954, Sour Lake, Tex. to Houston, Tex.

Gulf Refining Co.—63 miles, 8-10-in., under way, Lea County, New Mexico, to Anderson and Denton fields. Completed.

• **Magnolia Pipe Line Co.**—208-mile, 20-in. crude line planned from Corsicana to Magnolia's refinery at Beaumont, Tex. Work expected to start during second quarter of 1954 with completion set for 6 months. The line will cross the Trinity River 10 miles south of Oakwood and will pass near Crockett, Livingston, and Sour Lake.

56 miles, 8-in., contracted, Seminole, Tex., to Gladiola Junction, N. M. Completed.

• **Orchard Pipe Line Co.**—45-miles, 8-in., proposed to transport crude from Masters field in Logan County, Colorado, to point 4 miles northwest of Orchard. Estimated cost: $811,250.

• **Pasotex Pipe Line Co.**—153 miles, 10-

Pipe-Line Patrol

in., under way, Snyder to Wink, Tex. Completed.

• **Pawnee Pipe Line Co.**—35 miles of 10, 8, and 6-in. line proposed from Adena field in Colorado to Merino, Colo.

Phillips Pipe Line Co.—18 miles, under way, gathering lines, northeast area of Andrews County, Texas.

• **Progress Pacific Pipeline Co.**—1,100 miles, 24-in., planned, Odessa, Tex., to Los Angeles, Harbor, Calif.

• **Roosevelt Oil & Refining Corp.**—22 miles, 4 and 6-in., planned St. Helen to Norwich, Mich.

• **Sinclair Pipe Line Co.**—20 miles, 12-16-in., planned, Monee to Blue Island, Ill. Completion date 4-54.

• **Sioux Pipe Line System.**—Under study by Shell Pipe Line Corp. for group of 12 Williston basin producers. Length of line, pipe size, and terminal point pending final report by Shell.

Texas New Mexico Pipe Line Co.—52 miles, 10-in., under way, Dawson County to Basin System. McVean & Barlow. Completed.

Texas Pipe Line Co.—65 miles, 4-6-8-12-in., under way, South Louisiana. Panama-Williams. Completed.

Golden Meadow to Houma, La. Panama-Williams. Completed.

Gathering lines in Leeville, Bay De Chene and Golden Meadow pools. Panama-Williams. Completed.

• **West Coast Pipeline Co.**—960 miles, 24-26-in., planned. Wink, Tex., to Norwalk, Calif. $106,000,000.

Products Pipe Lines

American Pipe Line Co.—Line planned from Gulf Coast area to New York City area.

Badger Pipe Line Co.—215 miles, 8-10-12-in., begin Spring '54, East Chicago, Ind., to Madison, Wis. (Joint project of Cities Service Oil Co., Sinclair Pipe Line Co., Pure Oil Co., and The Texas Co.)

• **H. W. Bass & Sons, Inc.**—152 miles, 4-6-in., proposed. Duval and Live Oak counties, Texas, to Corpus Christi, Tex.

Frontier Ref. Co.—215 miles, 6-in., planned, Cheyenne, Wyo., to North Platte, Neb.

• **Great Lakes Pipe Line Co.**—Planned, extension 130 miles, 8-in., Nebraska City to Grand Island, Neb. To start March 1954.

150-miles, 8-in. to run from Iowa City, Iowa to Prophetstown, Ill., and to tie in to the Badger system there.

Harbor Products Systems—86 miles, 16-in., under way, Woodbury Junction, Philadelphia to Trembley Point, N. J. Construction Service Co. and H. C. Price Co. (Joint ownership of Sinclair Pipe Line Co., Gulf Refining Co., and Texas Pipe Line Co.) Completion date 1-54.

• **International Pipe Line, Inc.**—132 miles, 8-in., proposed, Wrenshall to Minneapolis, Minn.

Oklahoma Mississippi River Products Line, Inc.—475 miles, 12-in., under way, Duncan, Okla., to West Memphis, Ark. Ford, Bacon & Davis Const. Corp.

Under way, White River to Allen, Okla River Const. Co. Completion date 6-30-54

Under way, Allen to Duncan, Okla. River Constr. Corp. Completion date 6-30-54.

• **Phillips Petroleum Co.**—54 miles, 6-in., planned, Goldsmith to Borger, Tex.

52 miles, 10-in., planned, Shell's Brookshire system to Sweeny, Tex.

• **Triangle Pipe Line Co.**—560 miles, proposed, Arkansas City, Ark., to Covington, Ky., and Nashville, Tenn.

U. S. Gov't. Alaskan Products Pipe Line.—600 miles, 8-in., under way, Haines northward through British Columbia and Yukon to Fairbanks, Alaska. Williams Bros., Mc-

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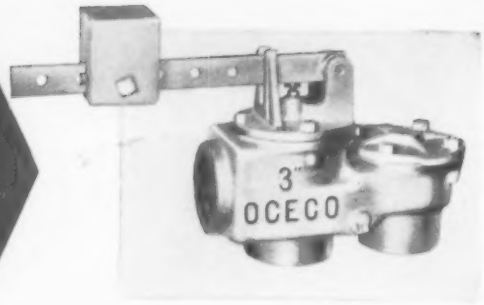

● These valves combine both vacuum relief and pressure relief in a single body and avoid the necessity of using two separate valves when both vacuum relief and pressure relief are desired. 3 inch, 4 inch and 6 inch sizes. Steel bodies. Bronze, stainless steel or aluminum trim. Can be furnished with vacuum relief settings from 1 oz. to 10 oz. per square inch. Pressure relief settings from 2 lbs. to 25 lbs. per square inch. For temperatures up to 650° F.— working pressures up to 30 lbs. per square inch. Write for fully descriptive data sheet.

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FOR MORE TROUBLE-FREE USE WITH LESS FUEL AND LESS MAINTENANCE

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THAT'S ONE-STOP SERVICE

Pipe-Line Patrol

Laughlin, Inc., and Marwell Const. Co. Completion date 9-55.

Williston Basin Pipe Line Co.—250 miles, 8-in., planned, Laurel-Billings, Mont., refineries to Glendive, Mont.

Wolverine Pipe Line System—200 miles, 14-in., under way, Chicago-Toledo-Detroit. (Joint ownership of Shell, Texas, and Cities Service.) Anderson Bros. and Midwestern Constructors, Inc. Completion date 1-54.

East Chicago, Ind., to Kalamazoo River. Midwestern Constructors, Inc.

Yellowstone Pipe Line Co.—(Continental Oil Co., Interstate Oil Pipe Line Co., Union Oil Co., and H. Earl Clack interest) 540 miles, 10-in., under way, Billings, Mont., to Spokane, Wash. 9-54.

Billings to Bozeman, Mont. Ross and Powers. Comp. July 1954.

Bozeman to Helena and on to Clinton, Mont. Associated Pipe Line Contractors, Inc. Completed.

Clinton to Perma, Mont. Associated Pipe Line Contractors, Inc.

Clinton to Perma, Mont. Eastern Pipe Line Fields Service Co.

Perma, Mont., to Murray, Idaho. Eastern Pipe Line Field Service Co.

Murray, Idaho to Spokane, Wash. Engrs. Limited Pipe Line Co. Total cost: $20,000,000.

Natural-Gas Pipe Lines

• **American-Louisiana Pipe Line Co.**—1,121 miles of 30 and 22-in., 30-in., proposed, extends from North Tepetate, Acadia Parish, Louisiana, to near Detroit. The 22-in. starts near Payne, Ohio, extends to Bridgman, Mich. Estimated cost: $130,000,000.

• **Associated Natural Gas Co.**—88 miles, proposed, Missouri.

• **Atlantic Seaboard and Virginia Gas Transmission.**—116 miles, 26-in., proposed, loops along Cobb, W. Va., to near Baltimore, Md.

Buzzards Bay Gas Co.—28 miles, 8-in., under way, Hyannis, Mass., to Bourne Bridge, Mass. Hallen Co., Inc. Completion date 2-54.

• **Carolina Natural Gas Corp.**—185 miles, 2-12-in., proposed, lateral lines off Transcontinental in North and South Carolina.

Chicago District Pipe Line Co.—19 miles of 36 and 30-in., completed of 35 miles planned. Remainder, all 30-in., will be completed in 1954.

• **City of Fayette, Ala.**—20 miles, 5-in. proposed, Fayette, Ala., to Southern Natural's system in Tuscaloosa County, Ala.

City of Dallas, Ga.—56 miles of 8 and 4½-in., distribution system. Engineering & Const. Co. Start April 1, 1954.

• **Coast Counties Gas & Electric Co.**—40 miles, 3, 4, and 8-in., planned. Coast and Valley region, California.

• **Colorado Interstate Gas Co.**—365 miles, 22-in., proposed, Green River, Wyo., to Denver, Colo. 1954.

49 miles, 20-in., proposed, Morton County, Kansas, to near Hooker, Okla.

Colorado Interstate Gas Co.—70 miles, 20-4-in., under way, gas-gathering system in Kansas. Engineering & Const. Co. 1-1-54.

243 miles, 4 to 20-in., under way, Colorado, Oklahoma, Texas, and Kansas. Engineering Const. and Z. J. Graham.

• **Colorado-Western Pipe Line Co.**—454 miles of undetermined size pipe planned between Cortez in Montezuma County and Denver. Line would serve towns of Montrose, Gunnison, Salida, Fairplay and South Platte, Colo. Estimated cost: $30,000,000. Company also plans 254 miles of laterals to service Colorado cities not now receiving natural gas.

328-mile line, proposed, to run from a point in La Plata County in southwestern Colorado over the Continental Divide along the eastern slope to serve Pueblo, Colorado Springs, and Denver. Estimated cost: $21,600,000.

• **Cumberland and Allegheny Gas Co.**—31 miles, 12-in., proposed, Garrett County, Md., to Keyser, W. Va. Cancelled.

East Tennessee Natural Gas Co.—96 miles, 16-in., under way, Knoxville, Tenn., to Kent line. Engineering & Const. Co. Completed.

54 miles, 4-12-in., under way, laterals off main line from Knoxville, Tenn., to Kent line. Engineering & Const. Co. Completed.

• **El Paso Natural Gas Co.**—1,178 miles, under way, Permian basin, New Mexico, Texas and Colorado. Spring '54.

El Paso Natural Gas Co.—771 miles, 30-in., under way, Plains, Tex., to Kingman, Ariz.

Section 1—Under way, Plains, Tex., to Corona, N. M. Oklahoma Const. Co.

Section 2—Under way, Corona to Suwanee, N. M. R. H. Fulton.

Section 3—Under way, Suwanee to Gallup, N. M. R. H. Fulton.

Section 4-5—Under way, edge to Navajo Reservation east to Flagstaff on to Kingman, Ariz. Western Pipe Line Const., Inc. Completion date 2-54.

Under way, across Navajo Reservation connecting sections 3, 4, and 5. El Paso Co crews.

Under way, Spraberry fields, El Paso Co crews.

• **Fort Worth Basin Gas Co.**—Planned, Novice, through Brown and Comanche counties, Texas.

• **Glacier Gas Co.**—285 miles, 20-in., proposed, Kalispell, Mont., to Spokane, Wash.

120 miles, 16-in., proposed, Spokane to Hanford, Wash.

91 miles, 8⅝-in., proposed, Spokane to Lewiston, Idaho.

130 miles, 12¾-in., proposed, Spokane to

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BARCO

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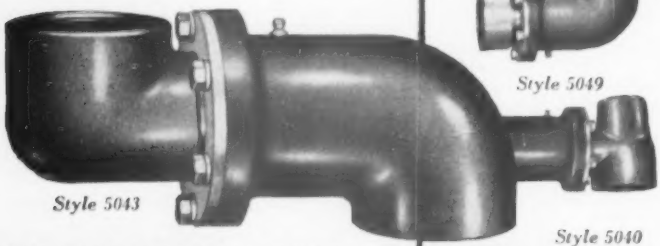

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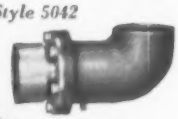

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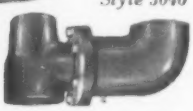

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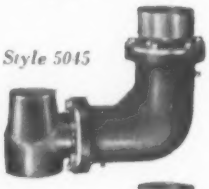

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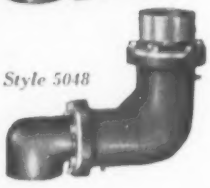

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Pipe-Line Patrol

International boundary at Trail, British Columbia.

Gulf Interstate Gas Co.—860 miles, 30-in., under way. Acadia Parish, La., to Boyd County, Ky. H. C. Price and Houston Contracting. 11-54.

Houston Contracting Co., Ltd., has completed 370 miles of its 500-mile contract from Rayne, La., to Kinkade, Tenn. Three spreads which have been working on the job are presently overhauling equipment and will not resume work until spring. Spread 1, headed by E. C. Norris, has completed 165 miles from the Mississippi River northward and it will resume work this spring.

Spread 2, headed by F. A. Silar, has completed 117 miles from the Ouachita River southward into the inception point of Rayne.

Spread 3, headed by M. L. Thompson, has completed 88 miles from the Ouachita River northward to the Mississippi River. It will begin work in the spring at the terminus of Kinkade, going south to join with Spread 1.

The remaining 360 miles is under contract to H. C. Price Co., Bartlesville, Okla. The firm has completed 279 miles and has 81 miles remaining which will be started in the spring. Five spreads, headed by G. A. Reutzel, R. L. Ezell, C. E. Shivel, C. R. Ice, and W. H. Olrich, have done the work. Price's contract covered the line between Gordonsburg, Tenn., and Catlettsburg, Ky.

Under way, Rayne, La., to Kincade, Tenn. Houston Contr. 370 miles laid. 130 miles left to be finished Spring of 1954.

Under way, Gordonsburg, Tenn., to Catlettsburg, Ky. 266 miles completed, 91 miles left.

230 miles, gathering lines, under way. Associated Pipe Line Contractors, Anderson Bros., Williams Bros.

329 miles, 12 to 24-in., proposed. Laterals off Acadia Parish, Louisiana, to Boyd County, Kentucky, line.

• **Home Gas Co.**—32 miles, 12-in., planned, Breesport to Union Center, N. Y.

17 miles, 12-in., proposed, loops from Hansock to Sanford, N. M.

Iroquois Gas Corp. and Tennessee Gas Transmission Co.—Companies planning joint storage project to be known as Colden storage field in New York. The following delivery and gathering lines are planned:

17 miles, 16-in. delivery line.

62 miles, 12, 8, 6, and 4-in. gathering lines.

• **Lateral Gas Pipe Line Co.**—27 miles, 4½ in., proposed, from Grant to Clarinda, Ia. Estimated cost: $267,200.

Lone Star Gas Co.—31 miles of 16-in. under way from Sulphur Springs, Hopkins County, to power plant near Johnstown, Red River County, Texas. Work being done by company forces.

Work will begin this month by company forces on 20 miles of 12-in. from Red Springs, Wood County, to 14-in. line connection in Smith County, Texas.

32 miles of 10¾-in. will start at Barnhart's gasoline plant in Reagan County and connect to applicant's 20-in. line in Upton County, Texas. Estimated cost $798,603.

• **Manufacturers Gas Light & Heat Co.**—40 miles, proposed, Allegheny, Washington, and Beaver counties, Pennsylvania.

213 miles, 3 to 26-in., proposed, various points on system in Pennsylvania, West Virginia, and Ohio.

72 miles, 16-20-in., proposed, Doddridge, Wetzel and Marshall counties, West Virginia.

• **Michigan Consolidated Gas Co.**—25 miles, 12-in., proposed, from near Sparta to Muskegon, Mich.

• **Michigan-Wisconsin Pipe Line Co.**—251 miles, proposed, 24, 18, 12, 6, and 4-in. loops. Majority will be in Illinois.

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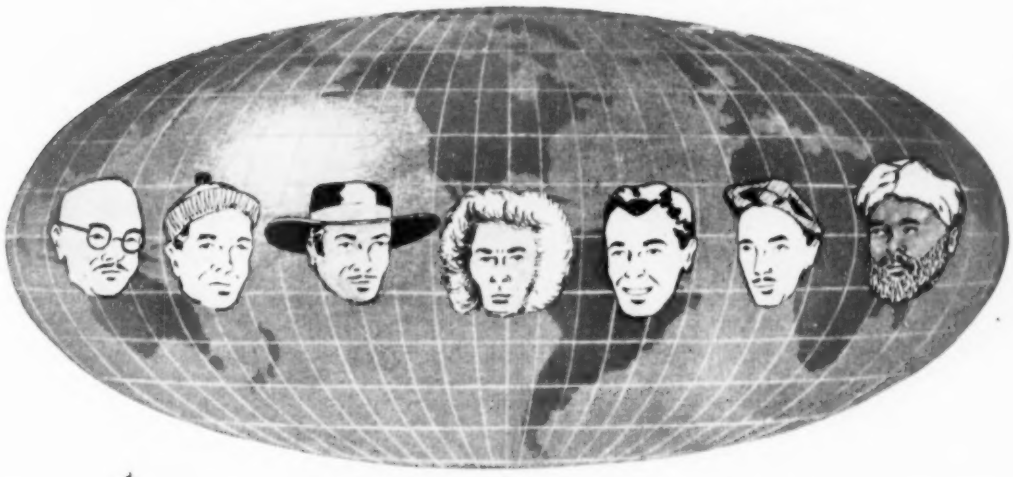

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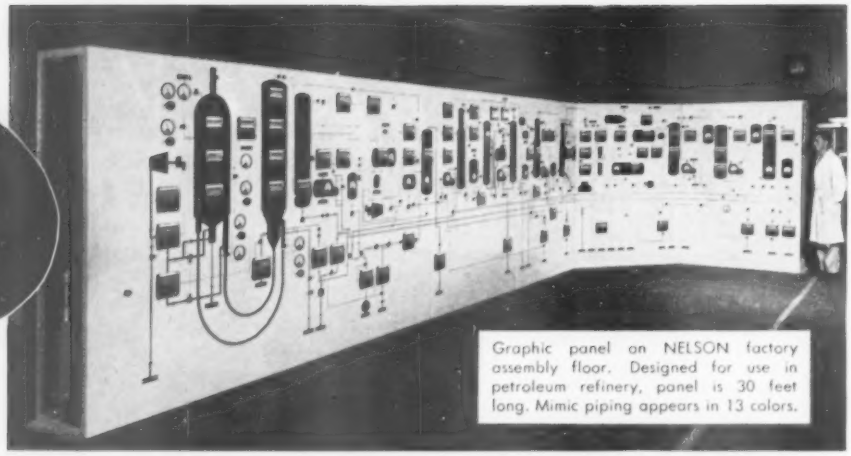

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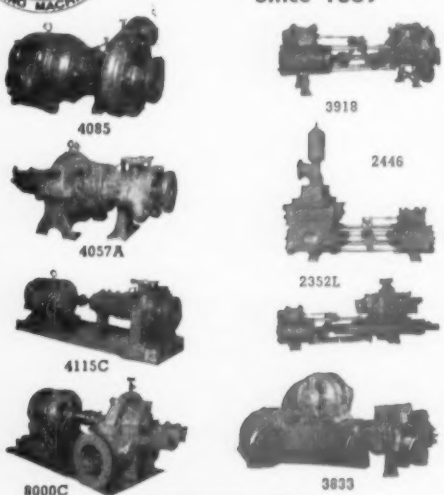

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The Kinney Automatic Self-Cleaning Strainer consists essentially of a revolving drum into which straining media are retained. To clean the media, a backwash opening is provided in the housing. As each section of media passes this opening, a reversal of flow occurs, and the foreign matter is flushed from the media. To reduce the amount of fluid lost in backwashing, the backwash may also be controlled by a solenoid valve, which automatically opens the backwash when there is a slight increase in the pressure drop.

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CARNEGIE, PENNSYLVANIA

Pipe-Line Patrol

Missouri Central Gas Co.—25 miles, 6-in., proposed, Moberly to Macon, Mo.

• **Missouri Public Service Co.**—136 miles, 8-10-in., proposed, New Franklin to Trenton, Mo.

24 miles, 10-in., Johnson County to Clinton, Mo.

• **Natural Gas Producer, Inc.**—100 miles, 12-in., planned, Yenter pool to Denver, Colo.

• **New River Gas Co.**—50 miles, planned, Summers to Monroe counties, West Virginia, to Narrows and Dublin, W. Va.

• **North Dakota Gas Transmission Co.**—470-mile line from Tioga plant of Signal Oil & Gas Co. and Beaver Lodge field to Fargo and Grand Forks, N. D. Line will have 78 miles of 12-in., 215 miles of 10-in., 70 miles of 8-in., and 107 miles of 6-in. Estimated cost: $10,800,000.

• **Northern Indiana Fuel & Light Co.**—35 miles, 8-in., planned, Edgerton to Auburn, Ind.

• **Northern Natural Gas Co.**—Company planning 359 miles of lines for 1954; 200 miles will be main line, 139 miles will be branch lines, and 20 miles will be gathering lines. Pipe size, areas, and amounts in dollars not announced yet.

• **Northwest Alabama Gas District**—40 miles, 9-in., proposed, Southern Natural's line through Windfield to Haleyville, Ala.

Northwest Natural Gas Co.—665 miles of unannounced size pipe to bring gas from Alberta, Canada, to the "Inland Empire" of northern Idaho and eastern Washington. Estimated cost: $36,000,000.

• **Ohio Fuel Gas Co.**—31 miles, 20-in., planned, Licking County to Richland County, Ohio.

22 miles, 16-in., planned, Dayton, Troy, Piqua, and Sidney, Ohio.

23 miles, 16-20-in., planned, Wellington to Elyria, Ohio; 16 miles, 20-in., planned, Benton Station to Crawford Station; 18 miles, 20-in., Crawford Station to near Columbus; 16 miles, 16-in., planned, Berlin to Sandusky, Ohio.

74 miles, 3 to 20-in., planned, Hocking, Knox, and Ashland counties, Ohio.

47 miles, 20-in., planned, Benton Township, Hocking County, to Columbus, Ohio.

61 miles, planned, northern and southwestern Ohio.

33 miles, 20-in., proposed, Jefferson to Seneca, Ohio.

69 miles, 20-24-in., proposed, lines to tiein Gulf Interstate line along various points in Lawrence, Jackson, Vinton, Hocking and Fairfield counties, Ohio.

Pacific Gas & Electric Co.—200 miles, 34-in., planned, paralleling Topock-Milpitas line. 107 miles contracted to Engineers Limited Pipe Line Co. L. E. Robertson is in charge of the spread handling work from Newberry to Danby and from Los Muertos Creek to Gilroy, Calif.

15 miles, 20-in., planned for completion in 1955 from Helm Tap to Helm Junction, Calif. Alex Robertson Co.

15 miles, 12-in., planned for completion in 1955. From Herndon to Madera, Calif. Company forces.

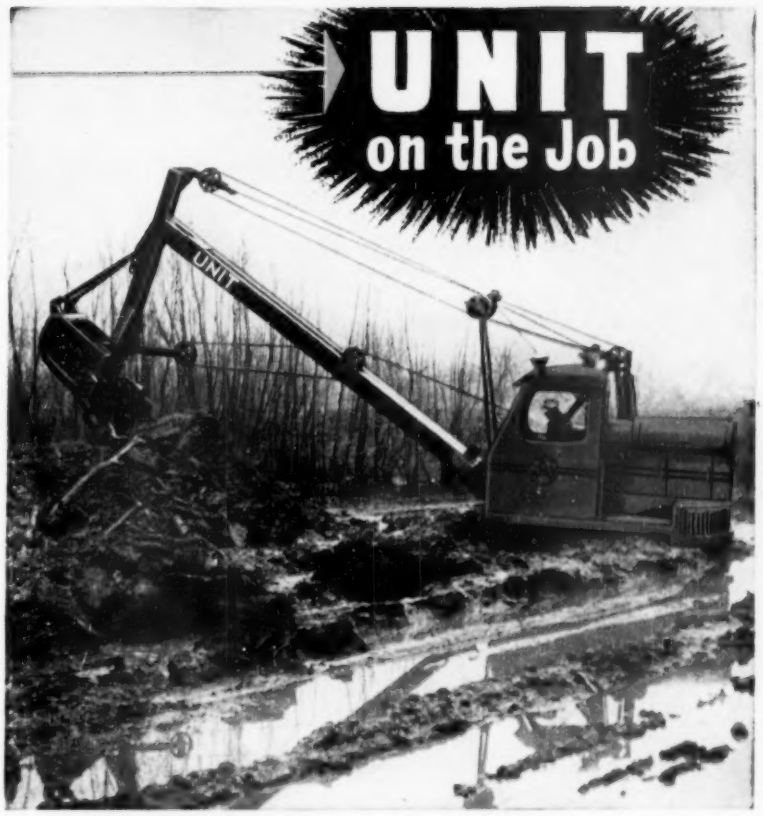
13 miles, 16-in., scheduled for completion in 1954. From Fairfield to Napa Wye, Calif. M.G.M. Construction Co.

30 miles, 10-in., scheduled for completion in 1954. From Corning field to Chico, Calif. Company forces.

19 miles, 16-in., from Wild Goose field to Yuba City, Calif. Scheduled for 1954 completion by company forces.

• **Pacific Northwest Pipeline Corp.**—1,466 miles, proposed, Ignacio, Colo., to Bellingham, Wash.

380 miles, proposed, laterals and spurs off



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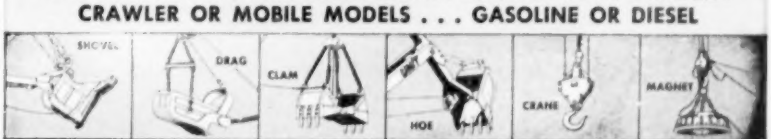

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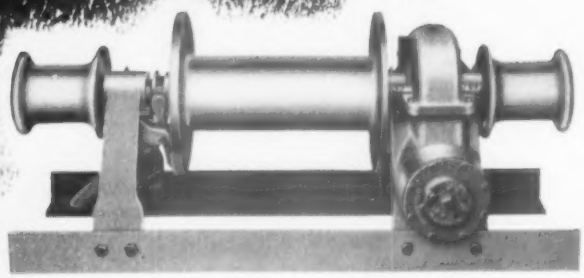
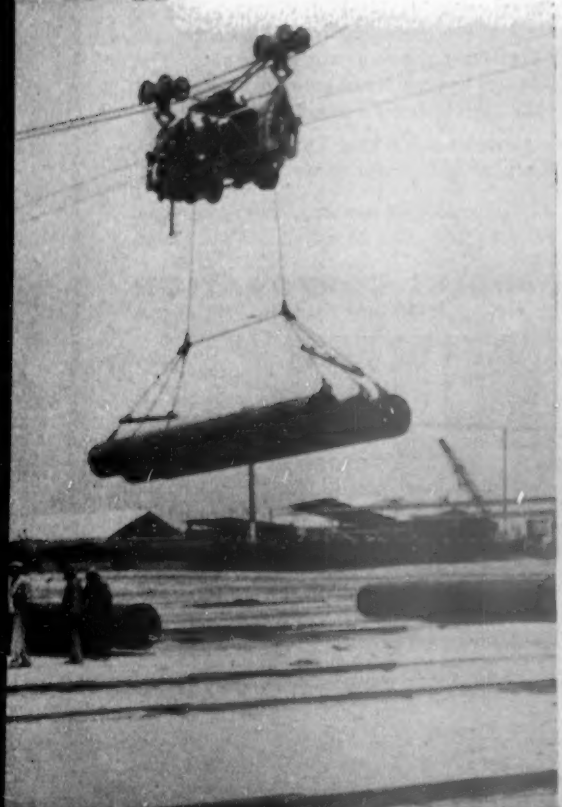


FOR A LIFT OR A PULL

PIPELINE CONTRACTORS USE

Tulsa* Winches



In Arabia or in Oklahoma, pipe line contractors rely on Tulsa Winch to handle the heavy work.

In the top illustration, this pipe line road boring machine is self-powered. The winch line from the Model 19 Tulsa Winch is anchored to a dozer or a tree and the Winch powers the machine forward by reeling in the line.

In the illustration left, a cable-way was erected to transport pipe from ships anchored in the harbor to shore. Pipe is lifted three joints at a time by a Tulsa Winch installed in the cable car. The car is self-powered.

These are just two illustrations of the versatility and dependability of Tulsa Winch. Tulsa Winches are made in 28 models, in capacities from 6,500 to 80,000 lbs. for all makes and models of trucks and crawler tractors.

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TULSA, OKLAHOMA
DIVISION OF VICKERS Inc.

*Reg. U. S. Pat. Off.

Pipe-Line Patrol

main line to Pocatello, Idaho, to Yakima, Wash.

Permian Basin Pipeline Co.—280 miles, 16-24-26-30-in., under way, West Texas and New Mexico. R. H. Fulton & Co. Completed.

• **Pine Tree Natural Gas Co.**—204 miles of undetermined size pipe to run from the Boston area to Bangor, Me.

• **Shenandoah Gas Co.**—39 miles, 3-4-8-in., proposed, Middleton, Va., to Martinsburg, W. Va.

• **South Georgia Natural Gas Co.**—339 miles, 2-12-in., planned, Phoenix, Ala., to Tallahassee, Fla. (a) 12-in., Phoenix, Ala., to Albany, Ga., (b) 10-in., Albany, Ga., to Moultrie, Ga., (c) 8-in., Moultrie, Ga., to Tallahassee.

• **Southeast Alabama Gas District.**—150 miles, 10 and 8-in., planned, Phoenix City to Dothan, Ala. Engineering Const. Co. Start April 1, 1954.

Southern California Gas Co., and Southern Counties Gas Co.—73 miles, 30-in., under way, loops on main line from Blythe to Los Angeles. River Const. Co. Completed.

Southern Natural Gas Co.—1,235 miles, 24 to 4½-in., under way, Louisiana, Mississippi, Albama, and Georgia, and South Carolina. Houston Contracting, Latex and H. C. Price. Fall 1953.

Gwinville to Pickens. Completion in 1954.

Gwinville, Miss., to Ellerslie, Ga. Completion in 1954.

• **Southwest Gas Corp., Ltd.**—26 miles, proposed, from P.G.&E. line to Victorville, Calif. Completed.

• **Tennessee Gas Transmission Co.**—574 miles, 30-in., planned, Kinder, La., to Portland, Tenn.

63 miles, 26-in., planned, loops in Ohio and Pennsylvania.

45 miles, 20-in., proposed, Buffalo, N. Y., to the U.S.-Canadian border near St. Catherines.

243 miles 24-in., planned, Coudersport, Pa., eastward across Pennsylvania, New Jersey, and New York to point near Greenwich, Conn.

• **Texas Eastern Penn-Jersey Transmission Corp.**—265 miles 24-in., planned, from Oakford Storage field in western Pennsylvania to Texas Eastern Transmission Corp.'s Compressor Station No. 26 near Lambertville, N. J. Estimated cost $30,755,000.

• **Texas Gas Transmission Corp.**—48 miles, 26-in., planned, loops from Memphis to Slaughters, Ky.

24 miles, 16-in. line proposed from North Tepetate field, Acadia Parish, Louisiana, to South Roanoke field in Jefferson Davis Parish, Louisiana.

• **Texas-Ohio Gas Co.**—1,435 miles, 30-in., proposed, Hidalgo County, Texas, through Arkansas, Mississippi, Tennessee, and Kentucky on to Spencer, W. Va.

• **Transcontinental Gas Pipe Line Corp.**—533 miles, 30-36-in., looping along Texas-New York line.

19 miles of 12.75-in. pipe starting at West White Lake field in Vermilion Parish, Louisiana, and connecting with applicant's transmission line in same parish. Estimated cost: $1,042,310.

• **Trans-Northwest Gas, Inc.**—246 miles, proposed, International Boundary near Osoyoos, B. C., to Washington and Idaho.

275 miles, branch lines.

United Gas Fuel Co., and Central Kentucky Natural Gas Co.—57 miles contracted, to Putnam County, West Virginia. H. C. Price Co.

• **United Fuel Gas Co.**—52 miles, 20-24-in., proposed, Wood County to Lanham, W. Va. Spring 1954.

57 miles, 30-in., proposed, Lanham in Kanawha County, West Virginia, to Gulf

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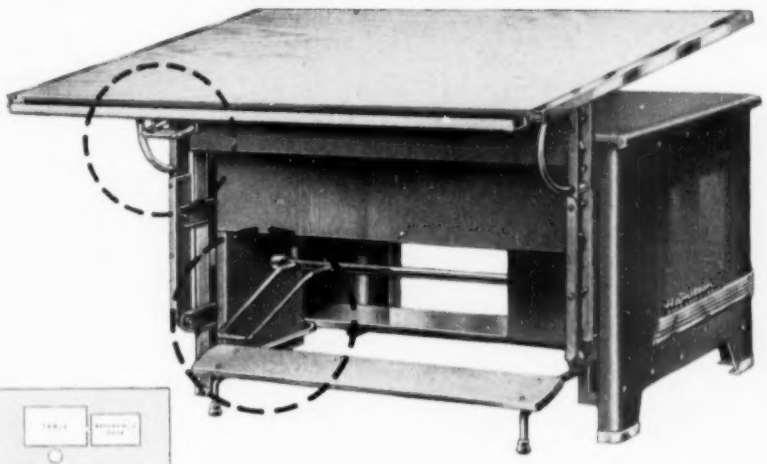

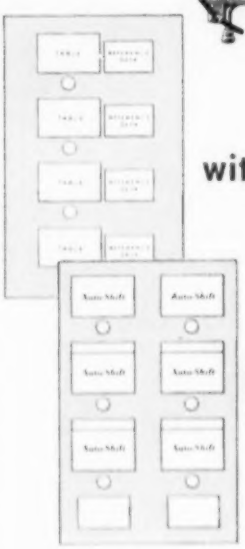

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Pipe-Line Patrol

Interstate line in Boyd County, Kentucky. Spring '54.

United Gas Pipe Line Co.—44 miles, 20-in., under way, Lirette field to Harvey, La. Brown & Root.

• **United Natural Gas Co.**—50 miles, 12-in., planned, Elk County to Jefferson County, Pennsylvania. Completed.

Utah Natural Gas Co.—63.7 miles of 18-in. line completed by R. H. Fulton Co. from Clear Creek field to Orem, Utah.

40 miles from Orem to Salt Lake City will be built of 16-in. pipe at later date. Contract not let yet.

Virginia Natural Gas Co.—153 miles, Buckingham to Richmond and Portsmouth, Va.

Warren Pipe Line Co.—54 miles of 4-30-in. to be completed March 15, 1954, by Western Construction Co., of Hobbs, N. M.

25 miles of 3-20-in. being laid in Garvin County, Oklahoma, by George W. Davis Co. Completion date not set.

Westcoast Transmission Co., Ltd. — (See foreign natural gas pipe lines).

Foreign Crude-Oil Pipe Lines

• **Arabian American Oil Co.**—18 miles, 22-20-in., planned, Qatif to Ras Tanura No. 3. Completion date 1-55.

Bombay Port Trust.—50 miles, 8 to 24-in., contracted, Bombay, India, to serve Standard Vacuum Oil Co., and Burmah Shell refineries. Merritt, Chapman & Scott Corp., contractors. (Crude and Products.)

Creole Petroleum Corp.—21 miles, 34-in. crude line to run from Lagunillas field to La Salina, Venezuela. Williams Brothers Overseas Co. has contract with construction slated to start in February and to be completed in 6 months. Line when completed will be the world's largest-diameter crude line.

Direccion General de Yacimientos Petroliferos Fiscales—409 miles, under way, Plaza Huincul to Bahia Blanca, Argentina.

Estrada De Ferro Santos A Jundiai Oleoduto Santos—Sao Paulo.—This Brazilian company has completed or recently started the following lines:

2 miles, 24-in. crude line from Junction to Refinery at Capuava. Completion, May 1954.

21 miles, 12-in., planned from Cubatao to Capuava refinery. Completion scheduled for June 1954.

8 miles, 18-in., planned from Junction to power plant at Cubatao. Completion set for March 1954.

6 miles, 8-in., products line, planned from Capuava refinery to Utinga. Completion set for March 1954.

• **Gaz de France**—200 miles, 12-in. Ruhr to Paris, France.

• **Interprovincial Pipe Line Co.**—600 miles 24 and 26-in. loops, planned, along Interprovincial system between Edmonton, Alta., and Superior, Wis.

• **Mid-Saskatchewan Pipelines, Ltd.**—Proposed line from Smiley Viking oil field to connect with Interprovincial Pipe Line Co.'s Kerrobert pump station.

• **Petroleos Mexicanos.**—145 miles, 12-in., considered, 18 de Marzo field via Reynosa to Monterrey, Mexico.

100 miles, planned, Ishthmus of Tehuantepec, Jose Colomo to El Plan field, Minatitlan.

72 miles, 12-in., proposed, Poza Rica to Atzacapotzalco, Mexico.

Petroleos Mexicanos.—125 miles, 10-in., under way, Jose Colomo to El Plan, Mexico.

• **Saskatoon Pipe Line, Ltd.**—56 miles, 6-in., planned, Milden to Saskatoon, Sask.

Texas Petroleum Co. — 60 miles, 4-6-in., under way. Pta. Nino de La Dorada.

• **Trans Mountain Oil Pipe Line Co.**—30 miles, 20-in. from Vancouver to General Petroleum's refinery under construction at Ferndale, Wash.

20-in. line planned from Ferndale to Burlington and a 16-in. line planned to Shell Oil Co.'s refinery under construction at Anacortes, Wash.

• **Yacimientos Petroliferos Fiscales Bolivianos.**—170 miles, 4-in., planned, Bermejo to Tupiza, Bolivia.

Foreign Products Pipe Lines

Anglo-Iranian Oil Co., Ltd.—18½ miles, 16-in., under way, Little Aden to Aden. Bechtel Corp. Completion date December 1954.

18½ miles, 6-in., under way, Little Aden to Aden. Bechtel Corp. Completion date December 1954.

15 miles, 12-in., under way, Kwinana to Fremantle, M. W. Kellogg Co. Completion date February 1955.

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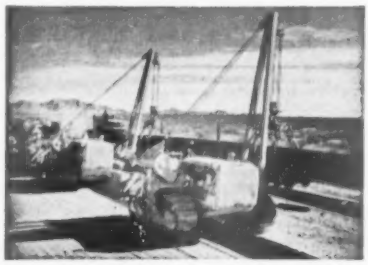

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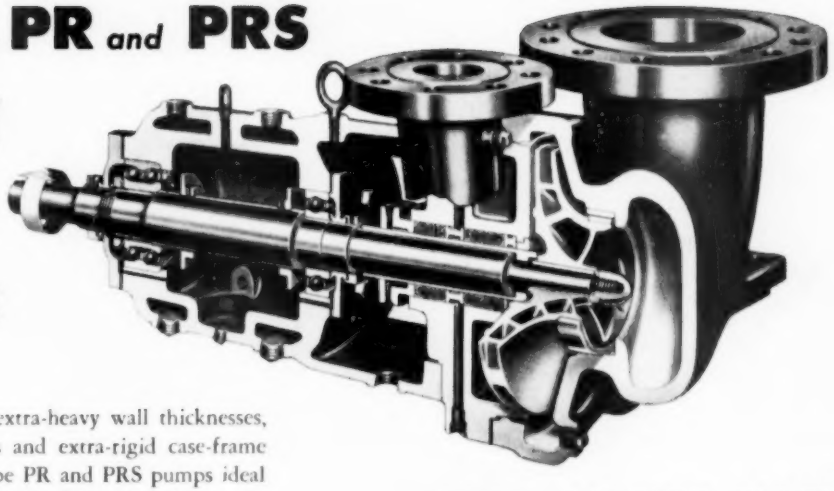


Maximum interchangeability, extra-heavy wall thicknesses, extra-low NPSH requirements and extra-rigid case-frame construction make Peerless Type PR and PRS pumps ideal for refinery process services. Furnished in a complete range of sizes, these Peerless pumps cover nearly all your pump needs. The option of adequate water-cooling jackets and water-cooled stuffing box or mechanical shaft seal design, plus heavy duty shaft with carefully balanced bearing design, are other features of this Peerless line of refinery process pumps. Many sizes are available from stock.

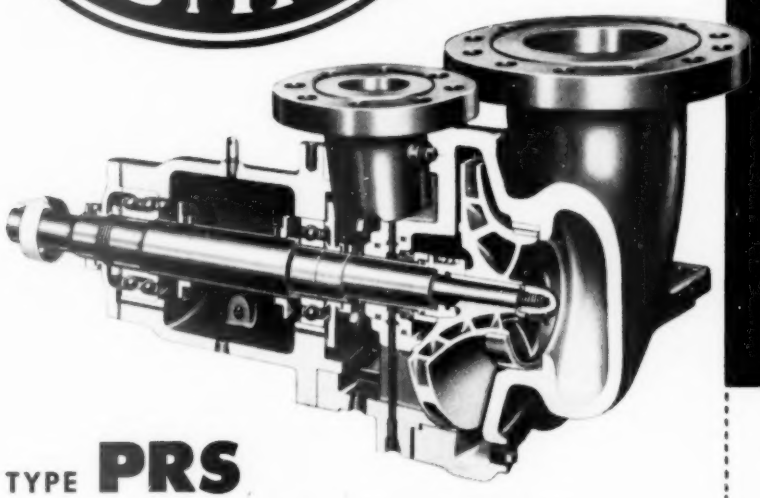
PEERLESS PUMPS

CAPACITIES: up to 1000 gpm

OPERATING HEADS: up to 675 feet

TEMPERATURES: Type PR (Packing gland construction) up to 850° F; Type PRS (Mechanical Shaft Seal construction) up to 250° F.

CASE PRESSURES: up to 600 psi



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APPLICATION:

Liquids handled: hot oil, hot water, propane, butane and all petroleum hydrocarbons, process liquors, Dowtherm, and numerous chemical solutions. Designed to operate with minimum available NPSH.

TYPES:

Two basic pump types. Type PR is packing gland construction; Type PRS is mechanical shaft seal construction. Both types are available in end- or top-suction, top-discharge designs. Horizontal electric motor drive is standard; other types of drive available.

ADVANTAGES:

Center-Line-Mount design maintains alignment at any temperature. Heavy-duty construction throughout. Spacer type coupling permits inspection or repair without disturbing piping. Liquid end can be furnished in cast iron, bronze, carbon steel, stainless steel or other materials as required.

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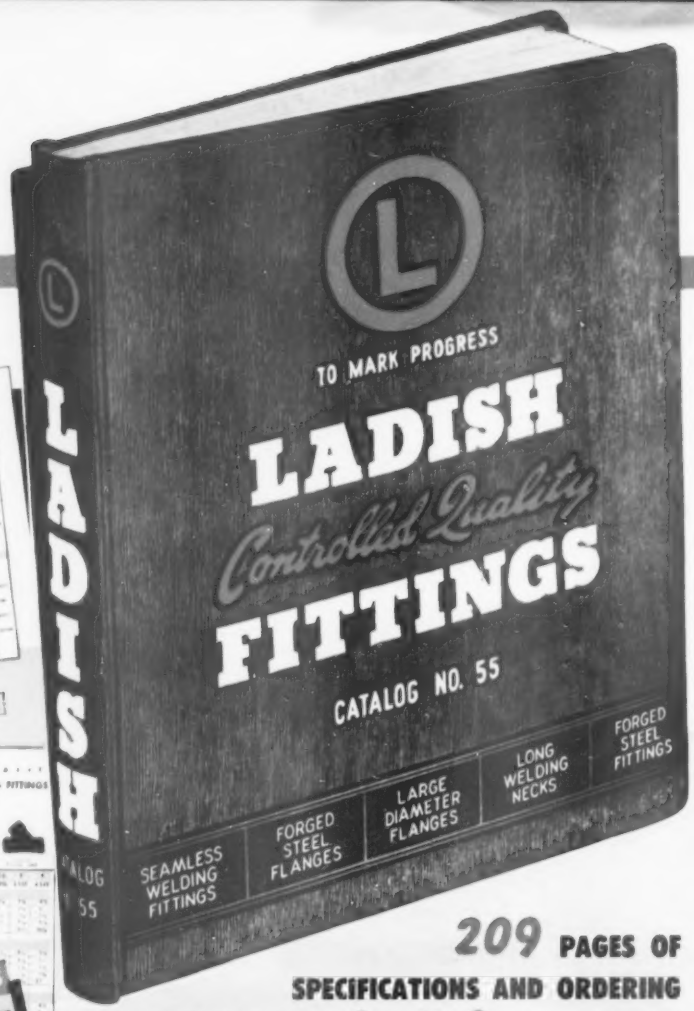

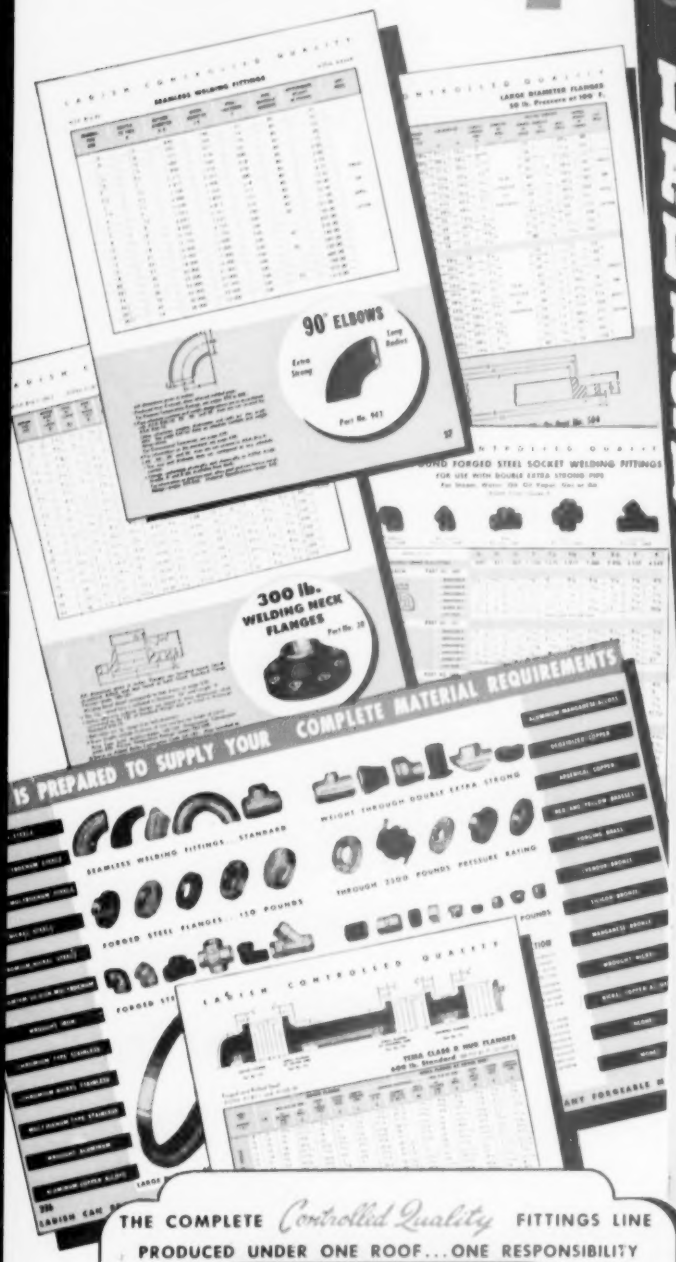

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56 PAGES FORGED STEEL A.S.A. FLANGES
Available in 150 through 2500-pound pressure ratings . . . in sizes ½ through 24 inches.

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Available in a complete range of types and pressure ratings . . . in sizes up to 160 inches in diameter.

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Available in 150 through 2500-pound pressure ratings . . . in sizes from 1 through 24 inches.

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Available in diameters up to 240 inches in a wide variety of forged contours . . . in weights up to 40,000 pounds.

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Screwed and Socket-Welding types in 2000 through 6000-pound pressures, sizes ⅛ through 4 inches.

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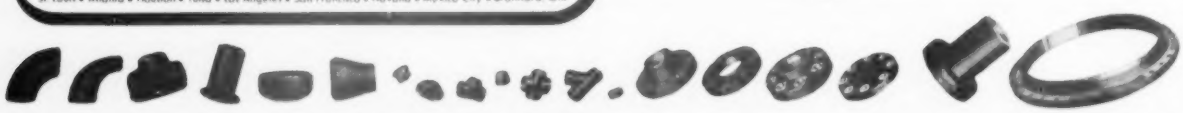

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Tabulations for ⅛ through 30-inch pipe in a wide selection of wall thicknesses and materials for operating temperatures from 100° F. through 1500° F., in power, district heating, oil transmission, refinery and gas piping systems.

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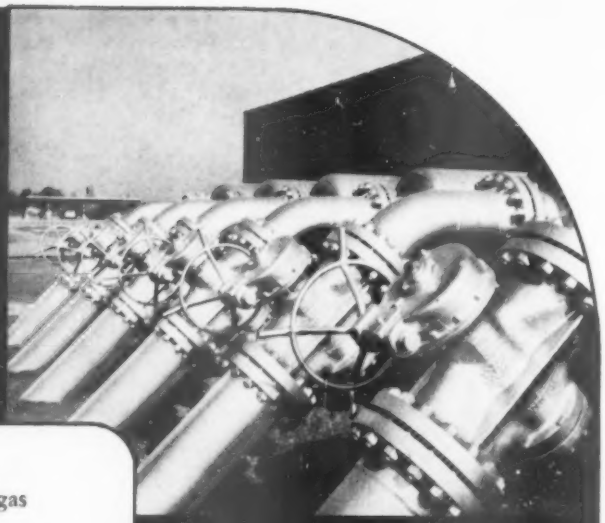

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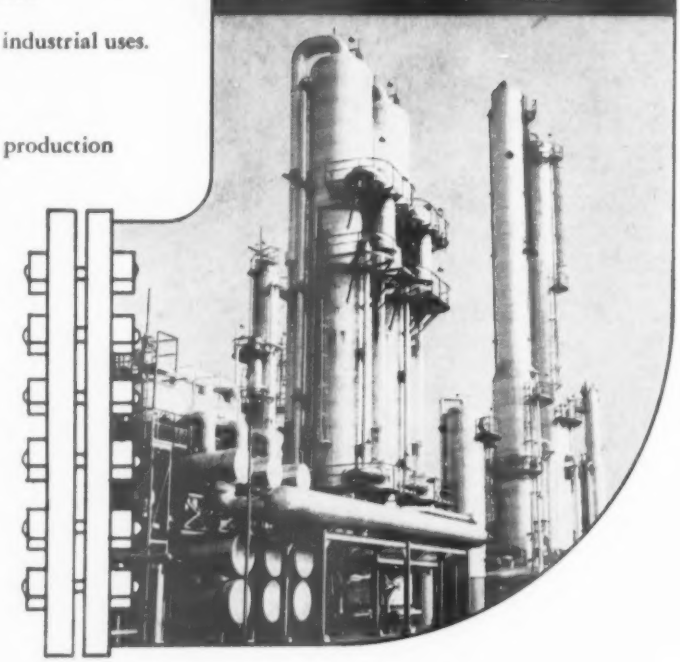

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PIPE LINES

Completion Near

Plains system to extend into South Clareton area

DALLAS.—Expansion of Plains Pipe Line Co.'s crude-gathering system in the Newcastle area of eastern Wyoming is well under way and should be substantially completed by April 15, a Plains official said here.

By that date, he said, a 25-mile, 8-in. extension of the system into the new and active South Clareton producing area and the new Red Bird pump station now being built about 50 miles south of Newcastle will be ready for operation. More than 100 miles of 4-in. field gathering lines also are being laid, and the majority of these also will be completed by April 15.

The present Plains Pipe Line system consists of an 81-mile, 8-in. line from Newcastle to Lance Creek and 93 miles of field gathering lines serving Mush Creek, Lance Creek, Fiddler Creek, Hay Creek, and North Clareton fields.

The system connects at Lance Creek with two parallel lines running to Guernsey, Wyo., about 70 miles to the south. These are Ohio Oil Co.'s line connecting at Guernsey with Service Pipe Line Co., and Rocky Mountain Pipe Line Co.'s line connecting with Platte Pipe Line Co.

The new construction will hike capacity from the present 17,000 bbl. daily to about 25,000 bbl. daily. During the summer months, capacity will be closer to 30,000 bbl. daily, the Plains spokesman said. The new capacity is expected to handle considerable production in the area now shut in because of limited line capacity.

If possible, he said, Plains will institute ratable taking from wells it serves. Wyoming law on the subject permits a pipe line to prorate on a "fair, just, and equitable basis." The spokesman said he thinks that ratable taking of 40, 50, or more barrels per well fits these requirements better than a system based on percentage of tenders.

Sale imminent . . . Controlling interest in Plains Pipe Line currently is held by a combine of the Murchison interests of Dallas and a group of stockholders represented by Keith Thompson, Cheyenne attorney.

Franklin County Coal Corp., a southern Illinois coal-mining company, has filed application with the Wyoming Public Service Commission to buy all assets of Plains Pipe Line for $2,396,000 *(The Oil and Gas Journal, March 15, page 183)*.

Murchison has no ownership in Franklin County Coal, but expects to obtain a controlling interest in negotiations now being conducted, the Plains official said. If the deal now before the Public Service Commission is approved, Plains will become the Plains Pipe Line division of Franklin County Coal, and operations of the latter firm will be directed from the Murchison offices in Dallas.

The Plains spokesman said that plans announced by another company to build a line to serve the same area would have no effect on Plains' expansion or other plans.

The competing company is N.N.C.W. Pipeline Co., which recently asked the Public Service Commission for authority to lay a $3,500,000 crude line from Clareton to Casper, Wyo., *(The Oil and Gas Journal, March 8, page 70)*.

Stricter Testing Outlined In A.S.A.'s Revised Code

NEW ORLEANS.—Hydrostatic testing of high-pressure pipe lines installed under city conditions will be mandatory under a revised code of the American Standards Association Subcommittee No. 8.

Addressing the recent meeting here of the American Gas Association's operating section, F. A. Hough, chairman of the subcommittee, said testing with either air or water will be permitted in fringe areas. Gas testing will be permitted under the code for open-country locations.

Under the proposed code, now being prepared, the industry will not be required to apply hydrostatic testing on a large scale—only on a small scale. However, Hough believes the industry will benefit by extensive hydrostatic testing on a voluntary basis. Such hydrostatic testing would be beneficial as the most satisfactory way to be assured of the soundness of pipe-line installations.

It is essential, Hough said, that modern transmission lines be: (1) built of good materials; (2) constructed properly, and (3) tested adequately.

Hydrostatic testing can safely go to materially higher pressures than if air or gas is used as the test medium. Testing can be done at pressure high enough above operating pressures to

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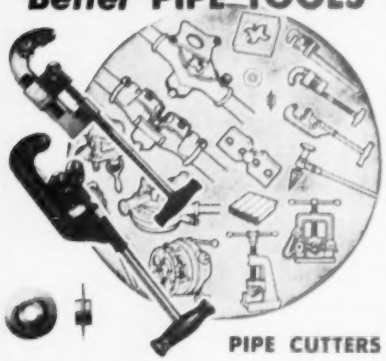

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demonstrate a substantial margin of safety. Hough had no objection to approaching the yield strength in testing. He feels that testing should be done to at least 25 per cent above the maximum operating pressure and that this is in line with what is generally recognized as good engineering practice in other industries.

Northern Natural System Expansion Work Approved

WASHINGTON. — Northern Natural Gas Co. has received Federal Power Commission authorization for the construction of about 204 miles of pipe line and 22,800-hp. in main-line compressor facilities.

The $23,776,000 project, along with additional branch lines which will cost about $14,659,057, is the final phase of an expansion program which will increase Northern's total system capacity by about 300,000 M.c.f. daily.

The initial phase of the expansion program, approved for construction but not operation last May 1, included about 259 miles of pipe line and 50,400 hp. in compressor capacity, and cost about $33,300,000, increasing Northern's system capacity by 200,000 M.c.f. Operation of the facilities was authorized by the FPC on December 24.

The additional gas to supply the expanded system will come from Permian Basin Pipeline Co., a Northern subsidiary, and will go to customers in the Midwest. Of the 114,927 M.c.f. of increased capacity not previously allocated, 70,101 M.c.f. has been allotted to new customers in more than 60 communities, 6,272 M.c.f. to Northern's Peoples division, and 38,554 M.c.f. to existing customers.

Pipe-Line Completion Scheduled This Month

FREEPORT, Tex.—A new pipe line linking Dow Chemical Co.'s Texas division plants with Collegeport-Citrus Grove natural-gas field in Matagorda County, northeast of Palacios and near the towns for which it is named, will be completed this month.

Construction of the 16-in. line started early in February. Three contractors are sharing in laying the 63-mile line. They are Panama-Williams Co., W. L. Golightly, Inc., and Associated Pipe Line Contractors.

When in service, the line will carry gas from the field control station at Collegeport to a new control station to be built at Dow's Plant A.

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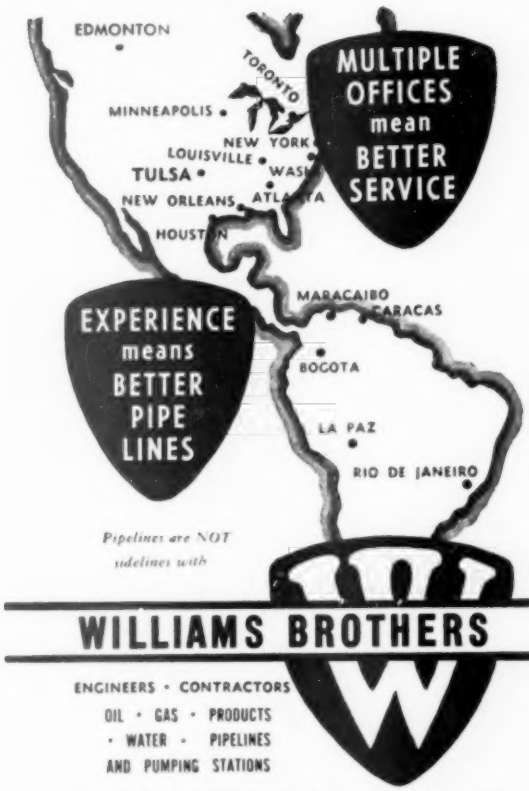

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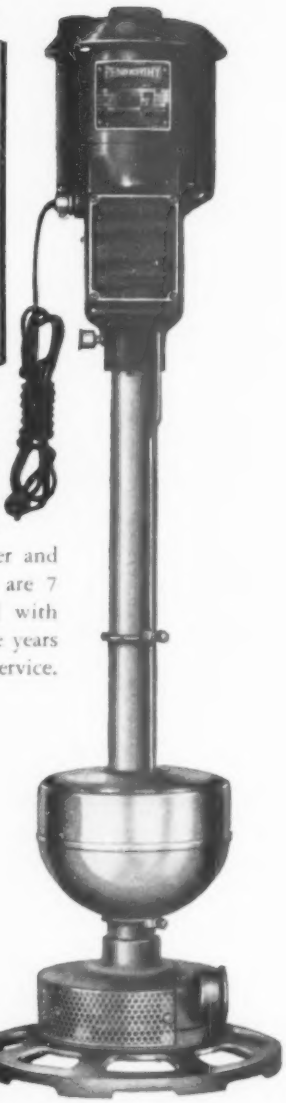

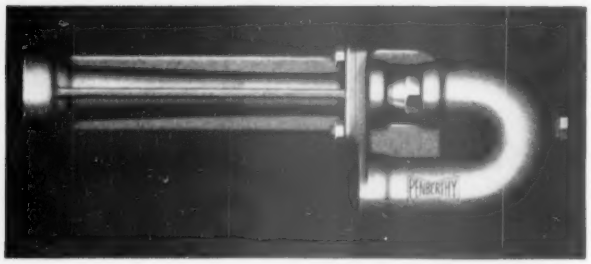

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REFINING

Nine Papers Set

W.P.R.A. annual meeting scheduled for next week

SAN ANTONIO, Tex. — Nine technical papers have been scheduled for the forty-second annual meeting of Western Petroleum Refiners Association in the Plaza Hotel here, March 29-31.

The papers, to be delivered in three technical sessions, will be concerned with fuels, coking, and refining processes.

Association business will include committee meetings, election of officers and directors, and meetings of the board of directors.

Papers to be delivered at the meeting are as follows:

March 29

A paper concerning gasoline volatility, T. W. Legatski, Phillips Petroleum Co., Bartletsville, Okla.; "Progress Report of W.P.R.A.-Bureau of Mines Distillate Fuel Research Project," Cecil Ward, U.S. Bureau of Mines, Bartlesville, Okla.; "The Development and Utilization of Amyl Nitrate as an Ignition Improver for Diesel Fuels," E. A. Desmond and Grover C. Wilson, Ethyl Corp., Detroit, Mich.

March 30

"Metallurgical Coke from Petroleum Pitches," M. D. Curran, Curran Carbonizing & Engineering Co., Kirkwood, Mo.; "The Fluid Coking Process," Dr. H. Z. Martin, F. T. Barr, and R. W. Krebs, Standard Oil Development Co., New York; "Phillips Pebble Heater," M. O. Kilpatrick, Phillips Petroleum Co., Bartlesville, Okla.

March 31

"The Dualayer Treating Process," A. C. Duval and V. A. Kalichevsky, Magnolia Petroleum Co., Beaumont, Tex.; "Ultraforming —A New Catalytic Reforming Process," J. H. Forrester, A. L. Conn, and J. B. Malloy, Standard Oil Co. (Ind.), Chicago, Ill.; "Unifining," Henry W. Grote and C. H. Watkins, Universal Oil Products Co., Des Plaines, Ill., and H. F. Poll and G. W. Hendrick, Union Oil Co. of California, Los Angeles, Calif.

Large Residual Stocks Force Heavy-Crude Cut

SAN FRANCISCO.—Heavy residual stocks are forcing Standard Oil Co. of California to shut in about 6,000 bbl. daily of heavy-crude oil production in California and to increase use of residuals for heat and power purposes in refineries by another 6,000 bbl. daily.

The company reports that all of its refinery facilities for processing residuals into lighter products are being used to full capacity and that it won't be able to handle additional quantities until new facilities are completed late this year.

Because of the large stocks of residuals, Socal plans to reduce imports of foreign oil into California through the second quarter by 10,000 to 12,000 bbl. daily from the January-February levels, bringing imports down to about 23,000 bbl. daily.

Texaco Builds Platformer At Eagle Point Refinery

WESTVILLE, N. J.—Construction has been started on a new Platforming unit and an alkylation plant, and expansion of other facilities at The Texas Co.'s Eagle Point refinery here.

Procon, Inc., of Des Plaines, Ill., is the contractor for the Platformer, which will have a capacity of 12,000 bbl. per stream day.

The alkylation unit, to be used in the manufacture of aviation gasoline, will have a capacity of 1,926 bbl. per stream day.

Other expansion work includes construction of an additional steam generator with a rated capacity of 275,000 lb. per hour, additional water-cooling facilities, expansion of present utility lines and the present power distribution system, and additional storage tanks with capacity of about 308,000 bbl.

Completion of the construction and expansion is scheduled for January 1, 1955.

Asphalt-Blending Plant To Be Completed April 1

INDIANAPOLIS.—The new plant of Trinidad Highway Co., designed for blending natural asphalt with oil asphalts, is scheduled for completion by April 1.

Under construction for the past year, the plant is said to be the first plant in the United States devoted exclusively to blending and compounding Trinidad natural asphalt with residual oil asphalts.

Petco to Complete New Platformer in 6 Months

MILWAUKEE, Wis.—A new $1,000,000 Platformer under construction at Petco Corp.'s refinery at Chicago,

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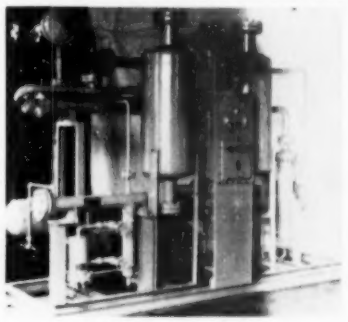

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is scheduled for completion within 6 months.

Procon, Inc., is the contractor for the unit, which will be used in conjunction with Petco's $3,000,000 Houdry catalytic cracker at the refinery to upgrade the octane of gasoline produced.

Petrochemicals

Urea Plant Planned

Chillicothe to build new petrochem plant

DALLAS.—Chillicothe Chemical Manufacturing Co., a newly organized firm, has obtained an option on a 100-acre tract about a mile east of Chillicothe in Hardeman County, North Texas, on which it plans to build a $17,000,000 anhydrous ammonia and urea plant.

Henry Brandon, president, said here last week the plant would process about 10,000,000 cu. ft. of gas daily to produce roughly 180 tons of anhydrous ammonia and 160 tons of urea daily.

The gas would be obtained from Lone Star Gas Co. which has a line and booster station less than a mile from the plant site. Estimated water need of about 1,500,000 to 2,000,000 gal. daily will be supplied from wells drilled to a recently discovered fresh water sand underlying the site at a depth of 80 to 300 ft. Brandon said the water will require no treating. West Texas Utilities Co., Abilene, will supply the estimated power need of 15,000 kw. daily.

Brandon said he expects within 2 weeks to be able to announce the name of the engineering firm engaged, the manufacturing process which will be used, and dates for beginning and completing construction.

Petrochemical Briefs

ST. LOUIS, Mo.—The increase in consumption of tricresyl phosphate (TCP) as a gasoline additive has prompted Monsanto Chemical Co.'s organic chemicals division to expand production of the product by 80 per cent.

BATON ROUGE, La.—Ethyl Corp. is expanding capacity of its plants here and at Houston, Tex., by about 15 per cent. Completion of the program is expected in March 1955.

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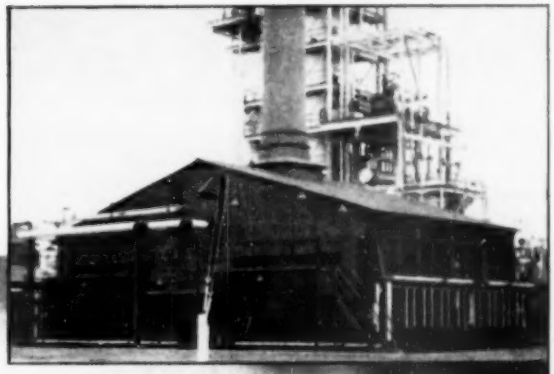

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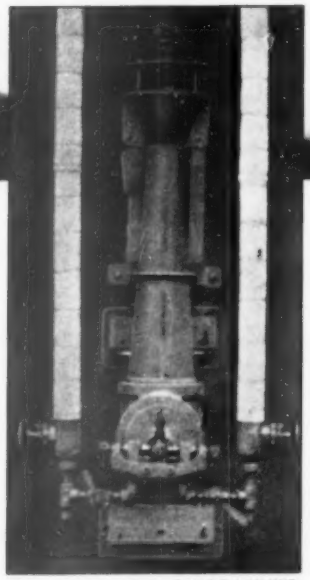

Showing one of the TANDEM UNITS in action . . . and photo at top right is an exterior view of the Crude Heater.

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The unretouched photograph above shows the interior of one end of a double-ended Crude Heater Furnace. Each end of this furnace is fired with eight (8) National Airoil "Airocool" Gas and Oil TANDEM COMBUSTION UNITS. Note how controlled *fuel oil* flames remain horizontal throughout the correct length of flame for maximum radiant absorption without impingement on bridge wall or roof tubes.

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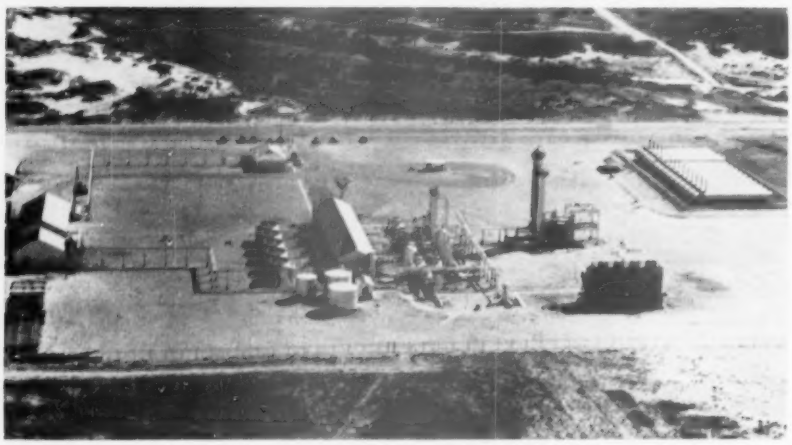

STEADY EXPANSION of Sun Oil's Jameson gasoline plant has increased gas-handling capacity from 6,600,000 cu. ft. in 1948 to a new high of 50,000,000 cu. ft.

Plant Expanded

Sun to finish project at Jameson plant this month

DALLAS.—Sun Oil Co. will have completed by April 1 an expansion of its Jameson natural-gasoline plant in Coke County, West Texas, boosting gas-handling capacity to 50,000,000 cu. ft. daily.

The plant is located about a mile south of Silver, Tex., in Jameson Strawn sand field. It extracts liquids from about 25,000,000 cu. ft. of gas a day. All other gas, plus residue gas from that processed, minus 10,000,000 cu. ft. sold to Lone Star Gas Co., is cycled back into the producing formation.

All compressors and other primary units of the expansion already are completed. Additional water-treating equipment now is being installed and should be in operation by April 1.

Production currently is running about 40,000 gal. of natural gasoline and about 50,000 gal. of L.P.G. daily.

Steady expansion . . . Actually, the plant has been undergoing steady expansion since it was first constructed in 1948. Initial plans called for installation of two compressor units, and for gas-handling capacity of 6,600,000 cu. ft. daily. Before these units were set, another was added. Then two more were installed in 1950.

In 1951 a two-stage gathering system was installed. Another, 1,350-hp. supercharged compressor was added in 1952 and the other five units supercharged by adding auxiliary blowers. Three more of the same size supercharged compressors have been added in the most recent expansion phase.

John Walke, chief engineer in Sun Oil's gas department here, says it's entirely possible that the plant is not through growing yet. One of the biggest factors in its growth, he said, has been the rapid development of Strawn sand pay in the area. Strawn production here, he said, is still spreading.

Commission Cannot Require Royalty Gas Dedication

AUSTIN.—The Texas Railroad Commission cannot require dedication of natural-gas production in Hugoton field for use as irrigation pump fuel, according to a ruling by Texas Atty. Gen. John Ben Shepperd.

The commission had requested a ruling by Shepperd on dedication of the gas after receiving a request for dedication of a portion of Hugoton field gas production for use as irrigation pump fuel *(The Oil and Gas Journal, February 1, page 119)*.

Shepperd, in his ruling, pointed out that the commission has authority to issue orders for prevention of waste of natural gas and to protect correlative rights, but that legally surface use of gas production for fuel in irrigation pumps is not "reasonably related" to those purposes.

Shepperd also said that the commission cannot issue an order providing a royalty owner may take his royalty gas in kind for use as irrigation pump fuel, unless the lease contract provides for such royalty payment.

As to whether the act of delivering gas from a gas well or from a pipe line for local use as irrigation pump fuel would make the deliverer a "gas utility," Shepperd said such a determination is statutory in each individual case and not within the commission's authority.

N.G.A.A. Sponsors Natural Gasoline-Analysis Project

TULSA, Okla.—The Natural Gasoline Association of America is sponsoring an analysis project in which 76 plant and research laboratories of 48 oil companies and 9 commercial laboratories are participating.

The laboratories are analyzing a deethanized natural gasoline, the exact composition of which is known only by the blender. Most of the analysis will be by low-temperature distillation, but 14 laboratories will also use mass spectrometry, 15 will use infrared, 1 will use the Fracton method, and 1 will use the absorption index.

A second phase of the project will be the analysis of a natural-gas sample by the same group of laboratories.

A. J. Miller of Phillips Petroleum Co. at Bartlesville, Okla., chairman of the N.G.A.A. fraction analysis committee, is in charge of the project. N.G.A.A. President Frank Perry, vice president of Cities Service Oil Co., said the objective of the analysis series is to determine and correct analysis procedure and to eliminate human errors in the laboratory.

El Paso Natural Gas Plans New Mexico Construction

WASHINGTON.—El Paso Natural Gas Co. has filed application with the Federal Power Commission for authorization for a $3,295,589 construction project in Lea County, New Mexico, which would enable the company to acquire up to 56,000 M.c.f. of additional natural gas daily in the Permian basin.

The construction project would include 13.3 miles of pipe line, 1,540 hp. in compressor capacity, a purification and dehydration plant, and metering facilities.

The project would permit El Paso to transport from the proposed plant, to be known as Monument treating plant, up to 110,000 M.c.f. of gas daily to its existing Dumas transmission line, to take an additional 25,000 M.c.f. of gas daily which is now being sold to Cabot Carbon Co., and to increase by 24,000 M.c.f. daily gas now being taken from Gulf Oil Corp.'s plant in the Waddell area.

Among the Drilling Contractors

Active Rigs Increase to Highest Level This Year

An increase since the first of the month of more than 100 in the number of rotary rigs operating in the United States and western Canada has boosted the total now running to more than 2,750, the greatest number so far this year.

The total is more than 120 greater than that reported at this time a year ago.

Drilling in Oklahoma continues at an active pace with the number of rigs in this state again above the 400 mark, the second time this year. In the West Texas-New Mexico area the number of active rigs increased to 812, a new peak for this year.

ACTIVE ROTARY RIGS*

Area—	Week ended 3-15-54	Change week ended 3-8-54	Change week ended 3-16-53
Gulf Coast	503	− 2	− 91
N. & W. Tex.-N.M.	812	+21	− 7
Ark.-N. La.-E. Tex.	193	− 3	+ 81
Oklahoma	408	+17	+ 83
Kans.-S. Neb.	161	− 8	− 19
Illinois-Eastern	131	+10	+ 31
Rocky Mountains	235	− 5	+ 57
Pacific Coast	155	0	0
Total U. S.	2,598	+30	+135
Western Canada	155	0	− 14
Total	2,753	+30	+121

*Courtesy Hughes Tool Co. Trends in drilling activity in the United States, Western Canada, and the Rocky Mountain area are shown on pages 404 and 405.

New Drilling Company

Evansville Drilling Co., Inc., is a newly formed contracting company operating in the tri-state area of Illinois, Indiana, and western Kentucky. Ron R. Miller, formerly drilling superintendent for G. W. Miller, independent operator, Mount Carmel, Inc., is president and general manager. Main office is at Evansville, Ind.

Arrow Drilling Co., Tulsa, is moving a rig to a wildcat location in Calhoun County, in the Black Warrior basin, of northeastern Mississippi, where it has contracted to drill an Ordovician test for Honolulu Oil Corp. Location is for 1 Davis, in 22-12-1e, approximately a mile northeast of Reid.

Penrod Drilling Co., Shreveport, has another Wilcox test under way for Hunt Oil Co. in Jefferson County, Mississippi. Location is for 1 Johnson, in 35-9n-2e, 1½ miles northeast of Fayette.

Falcon Seaboard Drilling Co., Tulsa, will drill another deep test for Amerada Petroleum Corp. in the Leleux area, 15

On the floor of a rig Carl Short, Inc., Dallas, has been operating under contract in Fort Bend County, Texas Gulf Coast. Left to right: Tony Volotko, field representative, Houston district, Mission Manufacturing Co.; Frank French, driller; Lee Richardson and J. E. Tyson, crewmen; M. J. Taylor, Wilson Supply Co., Houston; J. W. Goodson and W. A. Davis, crewmen. (Photo by courtesy Mission Manufacturing Co., Houston.)

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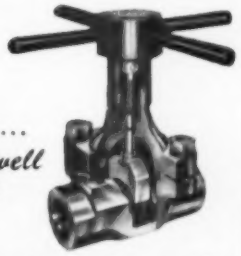

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miles northwest of Abbeville, in northern Vermilion Parish, Coastal Louisiana, where the company recently opened gas-condensate production. The new operation, 1 Trahan, the company's third in the area, is projected to 11,000 ft.

Bankhead Drilling Co., New Orleans, has a new operation under way for Pan American Production Co. in Witte gas field, in Victoria County, South Texas. Contract is for 1 Otto-Dodd Unit, in the Fernando de Leon Survey, a 5,400-ft. project. Location is 1,900 ft. southwest of the discovery well.

H. H. Howell is contractor on a new 5,000-ft. test Producers Corp. of Nevada has under way in the Steinmeyer area, 4 miles northwest of Tynan, in Bee County, South Texas. Location, 1 Bremer, in Refugio County School Land Survey, is 2,000 ft. from production in the two-well Steinmeyer field.

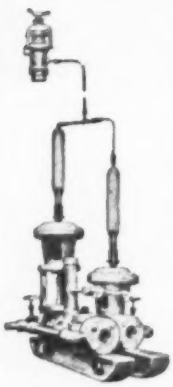
A. W. Williams Inspection Co., Mobile, Ala., is contractor on E. B. LaRue's third test now drilling in the Fancy Bluff area, in Glynn County, Georgia. The test, 1 Curry, in Lot 12, Block 92, is contracted to the basement, expected around 4,500 ft.

Crow Drilling Co., Inc., Shreveport, has contracted with Austral Oil Exploration Co., Inc., Houston, for an 8,000-ft. test to be drilled in the Bayou Middle Fork area, Claiborne Parish, North Louisiana. Location is 1,600 ft. northwest of Lyons, McCord & Logan's discovery well, completed in Bodcaw sand. The test is listed as 2 Margaret Meadows.

Rainbow Drilling Co., El Dorado, Ark., drilling for Curtis Kinard, one of the firm's owners, is starting a 6,800-ft. Travis Peak exploratory test in the old Holly field, in DeSoto Parish, North Louisiana. Location is for 1 Williams, in 18-13n-13w.

James O. Ruhl, Inc., Houston, has moved a rig to an outpost location 1¼ miles northwest of Sentell field, southeast of Benton, Bossier Parish, North Louisiana, where it is under contract for an 8,500-ft. test to be drilled for Pan American Production Co. at 1 Rushin-Vance Unit, in 32-20n-13w.

C. J. Foster is contracting for Warren Petroleum Corp. in the recently opened extension area on the east side of the Anse La Butte dome, in St. Martin Parish, coastal Louisiana. Currently drilling is the operator's 1 Dan, in 71-9s-3e, projected to 10,000 ft.



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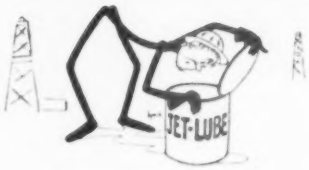

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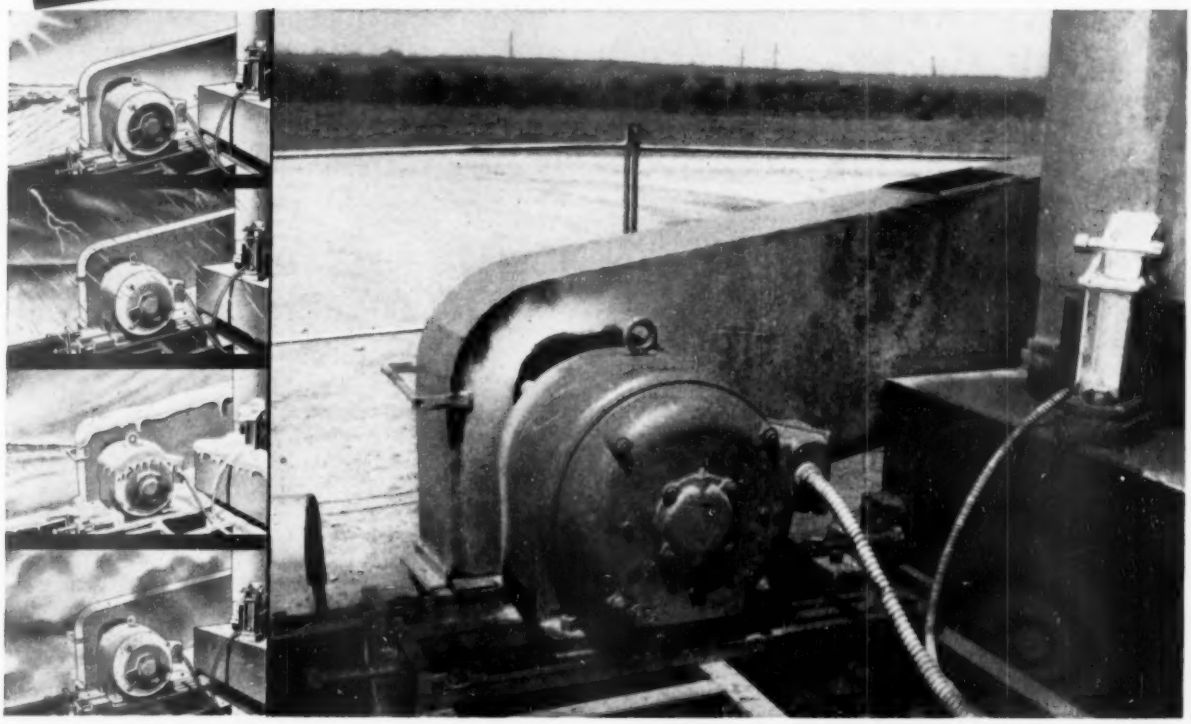

Wagner 25 hp splash-proof motor installed on a hydraulic long stroke pumping unit in Scurry County, Texas.

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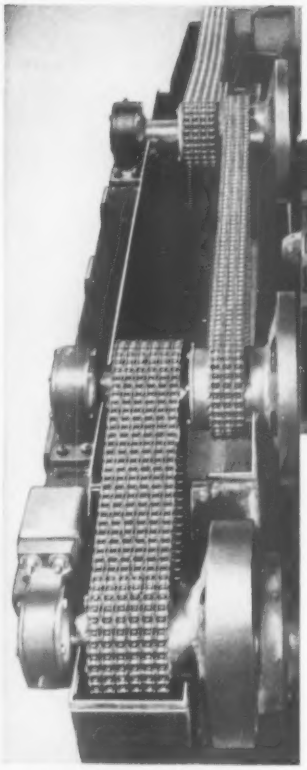
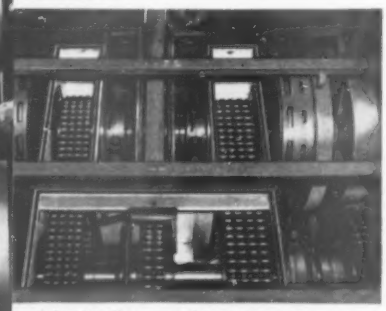
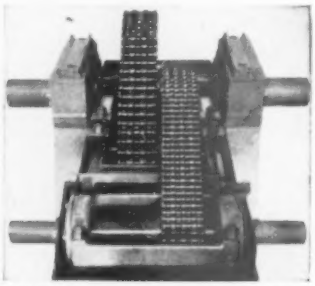


Since the first experiments in compounding the power of internal combustion engines on drilling rigs, Diamond multi-strand Roller Chains have provided the long-life dependability, reserve strength, and high efficiency demanded.



Adopting Diamond Chains for the transmissions provided the same dependability besides the flexibility machinery designers found so important.



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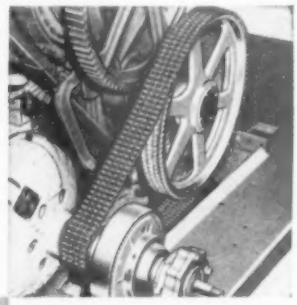

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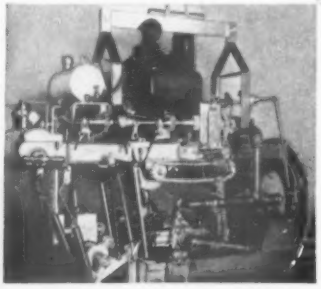

With 98-99% maintained efficiency, non-slipping, smooth operating Diamond Roller Chain Drives are top choice for power take-off applications.

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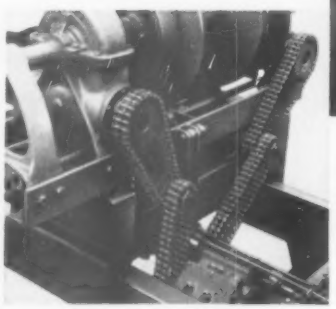


Positive non-slipping winch drives are among the earliest Diamond Roller Chain oil country machinery applications.

EXPLORATION

$100,000 Reward Still Unclaimed

by Frank J. Gardner

WANT to grab a wildcat by the tail? If you can make it purr with a Georgian drawl to the tune of at least 250 bbl. of oil per day, the State of Georgia will pay you $100,000 in cash.

That's been a standing offer for some little time now, and the reward is still unclaimed. There have been valiant efforts to collect it, but 57 dead cats is the score today in the Georgia oil hunt.

But geologists are not discouraged. Patience, as always, is the No. 1 word, for although drilling has been going on here since 1905, wildcat tests in the Coastal Plain have averaged fewer than one per year—this, in a prospective area the size of all northeastern Texas.

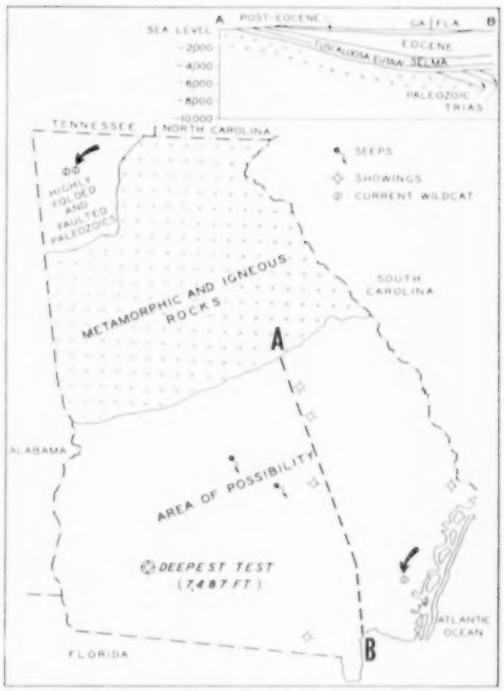
Within the "area of possibility" on the map lies 35,000 sq. miles of coastal territory that cannot be condemned for oil production on the basis of exploration work to date. Considering a total drilling program of 57 dry holes, this represents a test density of one well to each 393,000 acres—hardly a fair test ratio in a region of semipromise.

Oil hunters divide the state into three areas of possibility: (1) the northwestern corner, or Appalachian Valley, where highly folded and faulted Paleozoics complicate the probability of oil, (2) the Appalachian Mountain belt of basement rocks, condemned outright, and (3) the Coastal Plain, chief area of promise for oil, covering 59 per cent of the surface area of Georgia.

The absence of extremely thick sedimentary beds in the stratigraphic section has caused many exploration men to shy away from the Georgia Coastal Plain; but the relatively thin sections of Upper Cretaceous and Eocene marine sediments is in sufficient quantity to account for commercial source beds. A committee of the Mississippi Geological Society has reported an environment ratio of 90 per cent marine-10 per cent nonmarine for the subsurface section above the basement rocks in Georgia.

Drilling has indicated thicknesses ranging from a wedgeout zero at the northwestern margin of the plain to more than 7,500 ft. in southwestern Georgia, and 3,500 to 4,500 ft. in the southeastern corner of the state (section A-B on map). In addition to the Mesozoic and Cenozoic rocks, early Paleozoics and Triassic nonmarine beds have been logged by wells in the southern part of the state near the Florida and Alabama state lines.

Regional structural attitudes in the Georgia Coastal Plain are known with only a fair degree of accuracy. Geophysical surveys, subsurface correlations, and surface work have outlined a south-southeast-dipping homocline from its northern margin to the southern limit of the state. Major interruptions of this dip are encountered in the South Central Plain as the beds arch up and over the Ocala uplift of northern Florida, and in the southwestern corner of Georgia where the Marianna-Decatur uplift plunges southeastward out of Alabama.



Principal geological divisions of Georgia, with locations of seepages and showings, and showing three current tests. Cross-section reveals regional attitude of subsurface formations.

Two basin anomalies are found in southern Georgia; one, the Southwestern Georgia basin, lies between the Marietta-Decatur and Ocala uplifts and trends northeast-southwest. The other, the Southeastern Georgia basin, occupies the area following the Atlantic coastline.

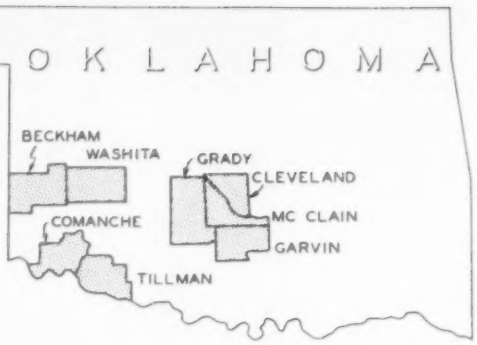
The exact nature and extent of these major structural expressions are still in doubt, and discovery of commercial oil fields in Georgia must await a more intense subsurface program to detail and define these and localized structures. Up to now, very few local prospects have been found. But sufficient drilling will undoubtedly result in the eventual discovery of structuro-stratigraphic traps, for many of the buried formations exhibit overlaps caused by sea transgression and regression, and strandline or shoreline reservoirs are highly probable.

Showings of oil have been reported in several tests over the state, notably in the Miocene, Wilcox, and Eutaw. Three good oil seepages have been described in the geologic literature, and others have been reported unofficially.

At the moment, three wildcat tests are active in Georgia (see map), and it is interesting to note that they are located in extreme opposite corners of the state.

Oil possibilities for Georgia can be described as good, then, on the evidence at hand: seepages, showings, favorable stratigraphic conditions, the likelihood of stratigraphic or structural subsurface traps, and the dogged determination of the American oil hunter. All of these factors cannot but lend themselves to the belief that one of these days, a buried oil factory will be found in Georgia, . . . and remember, it's worth $100,000 in cash to the detective who finds it!

Important discoveries and extensions are reported in eight South-Central and Southwest Oklahoma counties. Map (left) of South-Central Oklahoma shows recent new strikes and extension areas by name; they are keyed to the text by letter.



Three Oklahoma Areas Share In State's Record Activity

by John C. McCaslin

NEW discoveries and extensions in Oklahoma's south-central and southwestern counties have helped to keep the state's drilling activity at record levels.

Four counties in South-Central Oklahoma, Cleveland, McClain, Garvin, and Grady, have reported significant new strikes and development activity in recent weeks.

Successful completions in the area during the first 2 months of 1954 stood at 96 oil and gas wells, and 4 new officially completed discoveries. The most important strikes are located along the Purdy trend, in McClain County's Lindsay area, Garvin County's Royal and North Antioch fields, the West Helsel and Roulette Creek areas in Cleveland County, the Freeny trend in McClain, and in Grady County's Bradley pool area.

Southwestern Oklahoma's important new activity is located in Tillman, Washita, Jackson, and Beckham counties. Operators have completed nine oil and gas wells in these counties so far this year. Two discoveries, one from the Cisco lime and one from Granite wash have been scored in this area.

South-Central Area

Purdy trend (H on map) . . . Garvin County's Purdy Springer sand producing area has been one of Oklahoma's high-interest spots for 2 years. Northeast Purdy pool was opened late in 1952 at Magnolia Petroleum Co. 1 Duncan in 1-3n-4w, for an initial production of 566 bbl. of oil per day from the Springer sand. The pool produces from both the Springer sand and the shallower Hart sand. The Hart sand discovery well was Superior Oil Co. 1 Arner in 7-3n-3w.

This new Springer sand trend lies on the eastern rim of the Anadarko basin just west of the Golden Trend. Production in the Golden Trend fields is from the Pennsylvanian Deese, the Hart sand, and the Ordovician - Simpson series. No Springer sand is found in the Golden Trend. The Springer wedges out between the long Purdy and Golden trends.

An active program of connecting the area between the Purdy pools and the Golden Trend has been under way in recent months with good success. Development of the Purdy areas has been characterized by high-volume producers and good outpost success. Hart sand production has been established in the area between the two trends.

In Northeast Purdy pool Carter Oil Co. recently had a good well at 1 Hunter; it flowed 139 bbl. of oil in 6 hours on ¾-in. choke. Sinclair Oil & Gas Co. completed 2 Cooke in the same pool for 74 bbl. of oil in 10 hours from the Springer sand and 97 bbl. in 24 hours from the Hart sand. Amerada Petroleum Corp. 1-B Daugherty unit swabbed in, kicked off, and flowed 659 bbl. of oil in 13 hours natural from the Springer sand.

Sinclair extended Northeast Purdy pool ½ mile west recently at 1 Smith, dually completing the well in the Hart and Springer sands. On final completion the well flowed 235 bbl. of oil from the Springer in 12 hours through ¾-in. choke, and 107 bbl. of oil from the Hart in 10 hours through ¾-in. choke.

William R. Whittaker Co. will drill a west offset to the Southeast Purdy pool discovery and go to the Springer at 10,000 ft. The field was opened by Vickers Petroleum Co. and recently extended by Stanolind, Vickers, and Cities Service.

Lindsay pools (E on map) . . . Development activity in the Northwest and North Lindsay pools area of McClain County has picked up considerable speed. Several wildcats and extension wells are drilling in the area.

Sinclair Oil & Gas Co. recently cut the distance between the two pools with the successful completion of 1 Newcomb unit. The well flowed 718 bbl. of oil in 13 hours through ⅜-in. choke from the second and third Bromide sands. Sinclair also proved first Bromide sand pay at 1 Rayburn unit in Northwest Lindsay pool, flowing 385 bbl. of oil in 24 hours through 7/16-in. choke.

The discovery well of Northwest Lindsay pool was completed by Sinclair at 1 Community Smith in 1952 for 1,463 bbl. of oil per day from the McLish sand.

Royal and North Antioch areas (I and J on map) . . . Shell Oil Co. recently had a good well at 3 Cole in southwestern Garvin County's Royal pool. It flowed 91 bbl. of oil per hour for 3 hours from the Arbuckle.

Nelson & Spain will drill a 4,500-ft.

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wildcat on the west side of the field, which produces from several zones above 3,800 ft., including the Arbuckle. West Royal pool recovers oil from several zones below 6,500 ft.

Magnolia Petroleum Co. confirmed Viola lime production in new North Antioch pool in Garvin at the 1 Abernathy. It flowed 192 bbl. of oil in 24 hours through 24/64-in. choke. The new well is the northeast diagonal offset to the discovery well, Gene Goff 1 White, which flowed 134 bbl. of oil per day from the Viola.

Cleveland County (A, C, and D on map) . . . Ashland Oil & Refining Co.'s confirmation to new West Helsel field in Cleveland County has production in the Wilcox in 3 ft. of open hole. The well flowed 284 bbl. of oil in 15 hours through 24/64-in. choke. Ashland opened the pool at 1 Nance, which flowed 205 bbl. of oil per day through a small choke.

More development is expected at the north end of new Roulette pool as a result of successful completion at a well off the north flank of production. Lee Oil Co. and L. W. Barrett 1 Riordan flowed 140 bbl. of oil in 7 hours through ¾-in. choke from the Wilcox sand, open hole. In Southeast Roulette Creek pool Johnson & Gill et al completed 2 Steil on pump gage of 140 bbl. of oil in 12 hours from the Wilcox sand, open hole.

Calvert Drilling Co. 2 Foster is a new first Wilcox sand discovery in northeastern Cleveland County. The firm had previously drilled 1 Foster, but water encroachment ruined the well's chances for production. Better structural position was found at the 2 Foster.

Freeny trend (B on map) . . . Kenneth A. Ellison has spudded at an outpost try north of West Lindsay Ridge field in McClain County's Freeny trend. The operator previously completed 1 Johnson "A" in the field flowing 333 bbl. of oil per day from the Bromide sand.

The general deep Freeny trend has four producing areas in the eastern half of the township. The discovery well of North Freeny pool was Ellison's 1 Tankersley, 25-8n-4w. That well flowed 125 bbl. of oil per day from the Bromide sand. Jay Simmons et al opened the second pool in the area, North Freeny, at 1 Wilson, 14-8n-4w, with initial production of 411 bbl. of oil per day from the Tulip Creek. Both fields have been rapidly developed.

Ellison added Hart sand production to Osborn and Bromide found in Freeny pool. The well flowed 84 bbl. of oil in 14 hours.

Bradley pool area (F and G on map) . . . Phillips Petroleum Co. has extended Springer sand production in Bradley field, Grady County. Flow capacity reached 165 bbl. of oil in 22 hours. The discovery well, the 1 Lack, was finaled for a flow of 75 bbl. per day through a small choke from Springer sand perforations. Phillips has another deep test at 1 Steve, drilling below 11,350 ft.

Magnolia 1 Howell-Gragg established Springer sand production in Southeast Bradley pool. On completion test the well flowed 325 bbl. of new oil in 24 hours through 22/64-in. choke. Production is from perforations in the lower Springer sand. Two wells completed in the pool in 1952 lie ½ mile to the northeast. Production from both is from the Hart sand. Before plugging back, production tests were run at the 1 Howell-Gragg in the Bromide sand with perforations at 13,822-991 ft. This would have been record current deep oil production for Oklahoma, had the well been completed in that zone.

Southwest Oklahoma

Tillman County . . . Active exploratory work by Union Oil Co. of California in the state has paid off with the opening of another oil pool for the company. Union 2 Emenhiser, Tillman County wildcat, is rated at 96 bbl. of oil per day after swab test of Cisco lime perforations. The new discovery is located southeast of Frederick. Union has staked the 3 Emenhiser as an east offset. The 1 Emenhiser, first test in the area, was completed dry in the Arucklе lime.

Washita County . . . The first 24-hour production test at Gulf Oil Corp. 1 Goeringer, deep discovery well in western Oklahoma, made a natural flow of 271 bbl. of oil per day on 1-in. tubing choke with 1,750 M.c.f. of gas daily. The second test is being started on the unit, the 1 Fletcher, about ¾ mile southeast. It will go to 12,600 ft. Production at the Goeringer discovery is from Deese sand perforations at 12,229-366, 12,390-400, and 12,414-455 ft.

Jackson County . . . Gulf Oil Corp. has increased development work in old Altus field where production has gone up after a 20-year lull. The 8 Herbert is a new well in the field, and the 10 Edwards pumped 80 bbl. of oil per day from the shallow pay sands. Pumping equipment is being set up at two other indication successes.

Beckham County . . . Teci Production Co. has added the fourth shallow well to the new granite wash pool in the Carter Community area. The well swabbed 8 bbl. per hour. The well then flowed. The discovery well in the new pool is Earl G. Ward et al 1 Van Vactor. Teci has skidded rig to a second start in the field.

OKLAHOMA

New Pay in Kay Pool Reports Good Flow

A. C. Lawson 1 Cales, SW SE SE 20-27n-4e, flowed load oil and flowed 60 bbl. of new oil per hour after fracture treatment of the Bartlesville sand at the new extension area in Northeast Uncas pool, Kay County.

Orville H. Parker 1 McClaskey, NE NE NW 29-27n-4e, revived development in this pool in January, giving the one-well pool a ½-mile south extension. The well flowed 244 bbl. of oil per day on 24/64-in. choke from the Skinner sand.

Casing Run at Wildcat Southwest of Purdy

Max Pray 1 Eason, C SW SW 26-3n-4w, 1 mile southwest of Purdy townsite in Garvin County, South-Central Oklahoma, had a good gas show in the Hart sand zone on drill-stem test at 8,846-86 ft. The Gibson and Springer also showed good signs of production. The test is located 2 miles southwest of Northeast Purdy pool, a Hart and Springer sand producing area.

New Pay in Holdenville Townsite Development Area

Leta M. Chapman has added Hartshorne sand pay at 7 Bruner, SE SW NE 15-7n-9e, in Grief Creek field's west side, Hughes County. The discovery adds new hope that the Hartshorne sand may lie under the entire area. Most production is from the Booch sand in the field, which has expanded up to the edge of Holdenville. The Hartshorne discovery is completed for 20 bbl. of oil per hour, flowing through 15/64-in. choke from perforations at 3,130-38 ft.

Chapman is completing 8 Bruner, NE SW NE 15, in the lower Booch. It flowed 25 bbl. of new oil hourly through ½-in. choke from perforations at 3,120-34 ft. Eugene E. Majors 1 Majors, SE NE NE 17, ½ mile west of previous production in the field, is a new extension strike. The well flowed 85 bbl. of oil per hour through 2-in. casing choke from perforations at 2,934-81 ft. in the lower Booch sand. Owen H. Rives et al 1 Buchner-Benson, NE SE NE 17, flowed 80 bbl. of oil in 16 hours natural from the Booch sand through perforations at 2,970-75 ft. Chapman & Oliphant 5 Kernek, SW SW NW 16, flowed 20 bbl. of new oil through 15/64-in. choke from open hole after treatment at 3,001-36 ft.

Final Production Tests At North Jarvis Well

Final producttion tests are being made at Union Oil Co. of California 1 Larson, the fourth well in new North Jarvis pool, Grant County. The well flowed 8¼ bbl. of oil per hour in 11 hours on ½-in. choke from perforations in at 5,257-70 ft. in the Simpson. Gravity of the oil is 45.6°. The well is located in the SW SW NW 28-29n-6w. North

Jarvis pool was one of exploratory highlights of 1953.

McLish Oil Recovered At Centrahoma Pool

Carter Oil Co. has recovered some free oil from the upper McLish sand at 1 Centrahoma in Coal County's Centrahoma field, NE SE SW 27-2n-9e.

Recovered was 75 ft. of 39.4°-gravity oil plus 15 ft. oil-cut mud on drill-stem test taken at 6,410-28 ft. The test is going on down below 6,499 ft. to the Oil Creek sand.

The Oil Creek discovery for the field was made about 2 years ago at Twin Oil Corp. 1 Cody, C SW SW 27. This well tested the McLish at 6,383 to 6,407 ft. It netted 255 ft. of oil, 1,350 ft. muddy oil and 1,950 ft. salt water.

Southwest Navina

Success continues to follow the combination of Macmillan Petroleum Corp., Blackwood & Nichols and Richard S. Rheem, in Logan County, Oklahoma, when 5 Krout, the seventh producer in Southwest Navina field, was placed on production following a 24-hour test when the well flowed a net of 139 bbl. of 41°-gravity oil with 300,000 cu. ft. of gas.

Production is from the interval of 6,490-6,506 ft. in the Simpson dolomite. The well was placed on a 20/64-in. choke, tubing pressure was 175 psi. with a 25 per cent. The well is being produced at 90 bbl. a day to meet the Oklahoma allowable.

Three producing sands have been found in the field, the Layton, Simpson-dolomite and second Wilcox. The field was discovered February 25, 1953, when 1 Krout came in flowing 1,200 bbl. a day of 40°-gravity oil. The newest addition is located on a diagonal 10-acre location southwest and on the opposite side of the fault from the discovery well.

Geological Wildcat Has High Oil Flow

Stanolind Oil & Gas Co. is finishing up at a geological wildcat in Carter County, southern Oklahoma.

The 2 Nicholson, NW NE SW 3-1s-3w, flowed 415 bbl. of oil in 13 hours after being shut in for 3 hours. The good well flowed 20 bbl. of oil hourly during the last 2 hours of the test. Production is from perforations at 7,364-74, 7,458-78, and 7,500-7,520 ft. The good well is on the northeast flank of shallow production in Carter County's Tatums pool.

New Southeast Sunflower Pool Well Producing

A good well has been added to rapidlly expanding Southeast Sunflower pool in Central Oklahoma's Lincoln County.

E. L. Oliver 5 Ebert, SE NW SW 21-14n-2e, flowed 468 bbl. of oil in 16 hours, natural, on 10/64-in. choke from the Checkerboard sand.

Thick Pay Sand Indicated At Grady County Test

Cores indicate a thick pay sand with good indications of oil and gas production at Kidd Williams Drilling Co. and Pure Oil Co. 1 Godwin, Grady County.

The wildcat is 1 mile south of Chitwood pool in SE SW SE 10-4n-6w.

MICHIGAN

Drill-stem tests had been run in the Trenton and a 4½-in. liner was set at the W. C. Taggart 3 Wilson-Buers, NW SE SW 1-1s-7e, Salem Township, Washtenaw County, a test well located a flat ½-mile west of Taggart's 1 LeMaster Trenton oil discovery well.

Information regarding this test well was not generally available, but it was believed that the two drill-stem tests were run at a point equal to or below where oil was encountered in the discovery. (Most independent observers believe, and sketchy information indicated that these tests were run further in the Trenton than where oil was found at the discovery.)

Only semi-official indicated recovery on the drill-stem test was 450 ft. of gas-cut drilling mud, with gas showing to the surface, according to reports, in a quantity too small to gage, but enough to burn when lighted.

The 3 Wilson-Buers was said to be bottomed out at 4,224 ft., probably 212 ft. in the Trenton. Structurally, this test was believed to be about 273 ft. higher than the discovery producer. But if a pay has been encountered (and there are many reliable sources outside of the Taggart organization which say that it has), it was found further in the objective than was the pay encountered at the 1 LeMaster. It was expected that as soon as hole is conditioned and cleaned out following the running of liner, that better and more reliable information about this test well would be available.

A drill-stem test in the Richfield at the

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C. W. Jetter 1 Gingrich, NE NE NE 36-18n-14w, Pinora Township, Lake County, showed only 500 ft. of gas, 380 ft. of salt water and 60 ft. of drilling mud. Test was run for 6 hours at 4,660-96 ft. However, Jetter announced that he would perforate and test both the Richfield and the Detroit River "sour zone" at this first follow-up in Reed City pool to Pure Oil Co. Richfield sand discovery well. A break in drilling time and an electrical log survey indicated possible porosity in the "sour zone" over an aggregate of 12 to 14 ft.

KANSAS

New Discovery Hinted For Harper County

Frank Purcell and J. A. Mull, Jr., have a possible new pool discovery at 1 Dickson in the NE NE NW 8-31s-8w, wildcat 1½ miles northeast of Grabs pool in Harper County.

Recovery on drill-stem test in the Mississippian at 4,390-4,409 ft. was 90 ft. oil-cut mud. The strike is located 1½ miles northwest of a recent discovery at 1 Culver.

Flowing Discovery in Stafford Completed

Stafford County on the Central Kansas uplift has a new discovery at Natural Gas & Oil Corp. 1 Harrison, SE NE SE 13-24s-14w. It opens Rattlesnake Southeast pool.

Flow potential at the strike is 412 bbl. of oil per day from the Lansing lime. Perforations were at 3,758-68 ft. Hilton Drilling Co. has logged oil flow of 20 bbl. per hour from the Lansing at 1 Mason, ½ mile to the southwest of the 1 Harrison. It is located in NE NW NE 24-24s-14w.

INDIANA

In Gibson County Bury Beare-Baylor 1 Fithian-Lynch, Militia Donation 60-1s-60w, 7 miles northeast of Princeton, flowed 72 bbl. of oil per hour after acid treatment through McClosky lime perforations at 1,839-43 ft. Later it was choked to 37 bbl. per hour through 3-in. choke and is now flowing 15 bbl. of oil per hour after 8 days of flow.

ARKANSAS

Union Tuscaloosa Strike Completed on Pump

Austral Oil Exploration Co., Inc. and Lyons, McCord & Logan have completed 1 McGray, C NE NE SW 34-18s-16w, as a Tuscaloosa discovery ⅞ mile east of Wesson in Union County.

The well is pumping 79 bbl. of 44°-gravity oil per day from perforations at 3,105-10 ft. after fracturing.

East Stamps Confirmation Completed on Pump

C. G. Davis Drilling Co. has completed the north offset and confirmation to newly opened Tokio producing East Stamps field in Lafayette County. The test pumped 40 bbl.

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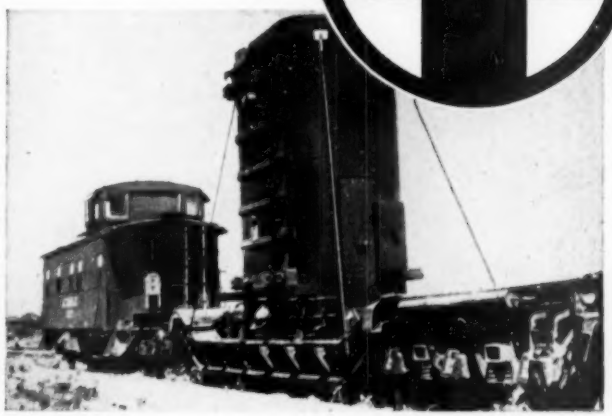

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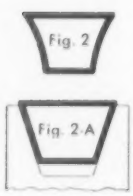
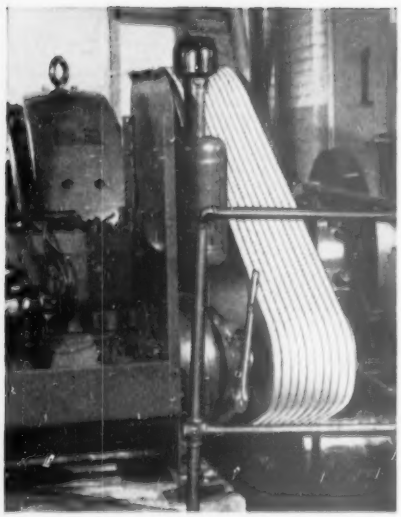


Instead of *bulging*, the precisely engineered CONCAVE SIDES merely *fill out* and become perfectly straight. This belt, when bent, *precisely fits* its sheave groove (Fig. 2-A). The sides of the Gates Vulco Rope press *evenly* against the V-pulley. Therefore, wear is distributed *uniformly* across the *full face* of this belt —resulting in *longer* belt life and *lower* belt *costs* for you!



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of 18°-gravity oil per day from perforations at 2,495-98 ft. in the Tokio.

The East Stamps discovery well, Davis 1 Strange, C W½ NW NW 14-16s-23w, pumped 90 bbl. of 19°-gravity oil per day on completion in February from perforations in the Tokio at 2,492-95 ft.

CANADA

Record Made For Week In Western Provinces

The Western Canadian oil industry chalked up a record discovery week for 1954 during the past 7 days, as oil or gas discovery was indicated at seven wildcats in the four western provinces, including Alberta, Saskatchewan, Manitoba and British Columbia. Although commercial prospects are not known at all of these strikes as yet, the week is an enviable one for explorers in the petroleum industry.

Alberta led the west, with three possible discoveries, including two with oil and one with wet gas. Two oil discoveries were indicated in Manitoba, while Saskatchewan contributed a gas discovery well (which also yielded some distillate) and British Columbia chalked up a similar find.

In addition to the week's discoveries, development operations in extension areas of the general Pembina region, some 65 to 70 miles southwest of Edmonton resulted in further knowledge at three important oil extensions in the Cardium sand.

Last week's wet gas discovery well at Elkton opened up additional Mississippian wet gas zone, and at weekend had been assured of some 60 ft. of pay zone, with a further 25 ft. being tested.

Greencourt area . . . Among the new strikes in Alberta was a light-gravity oil find in the Greencourt area of central Alberta, by Canadian Fina Oil, Ltd., on farmout lands from Canada Cities Service Petroleum Corp. This venture, Fina-Cities Service 6-7 Greencourt, LSD 6, 7-58-9w5, is 75 miles northwest of Edmonton and some 32 miles north-northeast of the Shell-Peers 2 venture that discovered Cardium oil.

The Greencourt well found its oil in the Mississippian limestone during test from 4,999 ft. to 5,024 ft. One-hour recovery consisted of 240 ft. of 30°-gravity oil and 50 ft. of oil-cut mud. An additional 15 ft. of oil-stained water-free core had been opened, and another 5 ft. of zone was also prepared for testing.

Garrington . . . At Garrington, 35 miles southwest of Red Deer and 63 miles northwest of Calgary, General Petroleums of Canada Ltd., New Superior Oils of Canada, Ltd., and Altex Oils, Ltd., discovered wet gas in D3 Devonian coral reef. The well also gave up a showing of light-gravity oil in a thin section of reef, but was found to be a non-commercial oil producer. The drilling group also deemed the wet gas zone as noneconomical to produce at this time, and abandonment plugs are being set at the well.

This deep venture topped the reef at 10,405 ft., and encountered some 85 ft. of wet gas zone prior to reaching a thin oil section, water and total depth. The well, Superior et al Hudson's Bay 11-33 Garrington, LSD 11, 33-34-4w5, is 7½ miles northwest of Shell's Westerdale oil discovery well.

Reno . . . The other Alberta find came at Shell's Reno wildcat, LSD 16, 25-80-17w5, 35 miles southeast of Peace River town and

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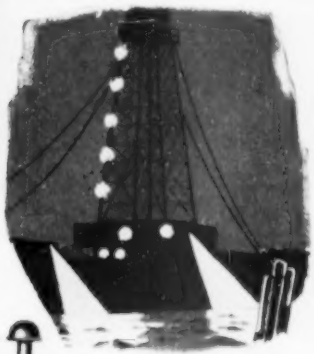

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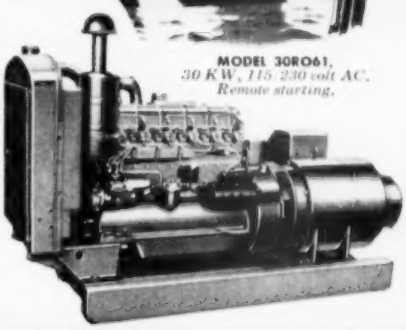

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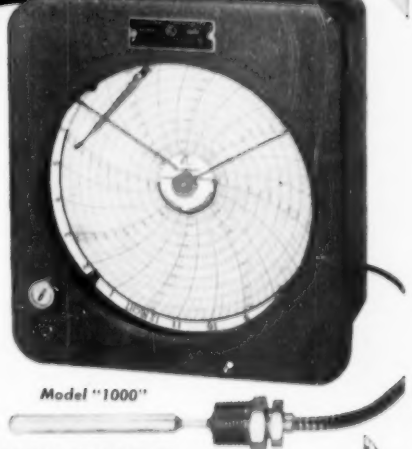

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2¼ miles southeast of the Shell-Imperial-Springburn well that last year found some oil in a similar section of the Devonian. The Reno well received its 35°-gravity oil in the Springburn member of the Devonian.

Only drill-stem test to yield free oil was run from 6,719-36 ft., which gave up a 1-hour recovery of 200 ft. of oil and 615 ft. of oil-cut mud. Tests below that interval gave up oil-cut mud, or oil-cut mud and salt water. Production string of casing is being run for potential tests.

Saskatchewan . . . Southeast Saskatchewan came into the limelight again this week, as a Canadian Gulf Oil Co. wildcat in that section of the Williston basin, indicated prospects as a large natural gas producer from the Mission Canyon section of the Mississippian limestone.

This venture, near the town of Frobisher, is Canadian Gulf-Canadian Devonian 9 Quinn, LSD 9, 34-3-4w2, 12½ miles north of the North Dakota border and 23 miles northeast of Estevan.

First test in the Mission Canyon, from 4,622-35 ft., flowed gas in 1 minute at maximum rate 6,500,000 cu. ft. daily and sprayed condensate. Recovery was 10 ft. of condensate. A second test was run from 4,635-45 ft., for 1 hour, and gas again flowed in 1 minute. Maximum flow rate was 10,000,000 cu. ft. daily, while recovery was 20 ft. of condensate, no water. Although neither of those above tests have been reported by the operating company, they have been obtained from reliable sources. Coring and testing is continuing.

British Columbia . . . The British Columbia gas strike was made in the Blueberry Mountain region, 45 miles northwest of Fort St. John by J. B. White, Texas oil operator, and associates. The venture is in unsurveyed territory.

Discovery came in the Permo-Pennsylvanian formation during test from 6,871-96 ft. Gas flow was estimated at rates between five and ten million cubic feet daily, and pipe recovery was 60 ft. of naphtha and 360 ft. of gas-cut mud.

Manitoba . . . Both the Manitoba oil discoveries this week are in the southwest sector of that province. One, drilled by the California Standard Co., is 1-12 South Virden, LSD 1, 12-10-26w1, 3¾ miles south-southeast of the main sector of Roselea oil field. No drill-stem tests were run, but after perforating the Mississippian interval 2,083-91 ft., light oil was swabbed at rate 3 bbl. hourly. Testing was being continued in effort to evaluate the well's commercial potentialities.

The other Manitoba oil find was drilled by the British American Oil Co., Ltd., near Woodnorth, 6 miles southeast of Daly oil pool at Virden. Several drill-stem tests were run in the Mississippian between 2,465 and 2,497 ft., and gave up varying amounts of oil, oil-cut mud and salt water. Gravity of the oil was 35°, and it is not as yet known whether or not it will be possible to produce this well commercially.

EASTERN CANADA

Ontario . . . Drilling operations in Aldborough Township, Elgin County, are being extended south and east into Southwold Township. Evan and Douglas Smelser, who have put down a number of the Aldborough wells for various interests, are drilling on the Chester Brown & Son farm in the north part of Southwold, 11 miles northwest of St. Thomas. The test is below 600 ft., and expected to reach the producing horizon somewhere above 1,400 ft.

The Ontario government has indicated that

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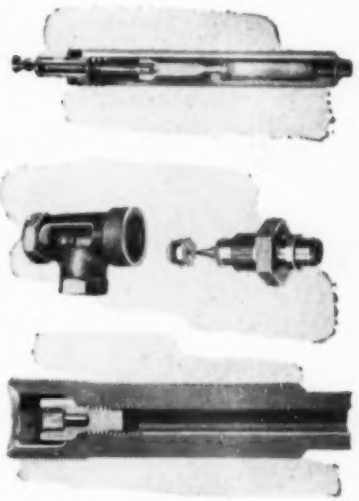

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arrangements are being made by unnamed interests for drilling in the bed of Lake St. Clair, south and west of Walpole Island. The lake bed at this point is comparatively shallow. Farther north, in Lambton County, gas and oil production has been secured by Imperial Oil and allied interests at Becher field, in Sombra Township, and latterly efforts have been made to secure drilling concessions on Walpole Island Reserve from the Indian council, so far without success. The lake drilling will test a potential extension or recurrence of Becher field production still farther south and west.

KENTUCKY

EASTERN KENTUCKY

Kentucky West Virginia Gas Co. has completed 1,017 Allen Wireman on Licking River in Magoffin County as a gas well in the Pennsylvanian Salt sand. Sand topped at 940 ft. and bottomed at 1,036 ft. total depth flowed naturally at the rate of 391,000 cu. ft. of gas daily with a rock pressure of 210 psi.

In Big Sandy gas field and located on Clear Creek in Knott County, Kentucky West Virginia Gas Co. have completed 6,161 Russell Begley for 273,000 cu. ft. of gas daily from Devonian black shale at a total depth of 2,774 ft. Well was shot with 4,300 lb. of gelatin.

WESTERN KENTUCKY

In Henderson County, south of Smith Mills, 1 mile north of the Magnolia, Gabhart lease, Wm. E. Styles has a good discovery at 1 Gabhart, 11-P-21. The McClosky lime well gassed in 35 minutes and recovered 600 ft. of clean oil, no water, on drill-stem test at 2,567-77 ft. The test was for 2 hours.

APPALACHIAN AREA

OHIO

National Oil & Gas Co. 2 Mary Christ, Section 13, Thorn Township, Perry County, intended for Clinton sand oil, topped the Newburg at 2,270 ft. and finished at 2,275 ft. with a gage of 2,000,000 cu. ft. natural.

Oxford Oil Co. extended Roseville pool ¼ mile to the west with a producer on 1 J. W. Diltz, Section 4, Harrison Township, Perry County. Clinton sand at 3,495-3,547 ft. showed 3 bbl. natural and 50 bbl. in 24 hours after fracturing.

The shallow oil pool at Senecaville Lake in Guernsey County is attracting considerable attention, if for nothing less than the number of rigs moved in. At the last count, rigs up and drilling totaled 15 with several more ready to start.

WEST VIRGINIA

Glade district, Webster County, West Virginia, Gregory Gas Co. has made two new wildcat locations. They are on the Cowden Quadrangle. 1 O. R. Miller, elevation 2,360 ft., 0.020 mile south of latitude 38 degree 25 minutes, and 1 L. D. Smith Hrs., elevation 2,248 ft. 0.60 mile south and 3.80 miles west of the same latitude and longitude. Middle Fork district, Randolph County, Washington Natural Gas Co. 1 J. E. Hanifan et al, wildcat, after treatment, finished at 225,000 cu. ft. gas, Fifth sand 2,251-2,303 ft., gas 2,252 ft. Total depth 2,620 ft.

SOUTHEAST NEW MEXICO

Third Pay Zone Opened At Sho-Bar Field

Western Natural Gas Co. 2 Ramco-State, southeast extension in the Sho-Bar field, has been completed as a new-pay discovery. Potential was 303 bbl. of 43° oil a day from perforations in the Pennsylvanian at 10,440-10,505 ft. The field produces high-gravity oil from the Bend section of the Pennsylvanian, and the Devonian.

Buffalo Oil Co. 25-A Baish, multipay discovery in 21-17s-32e, 1 mile northwest of the firm's Devonian discovery in Maljamar field, made a flow of oil from the Strawn. On test between 11,576-11,673 ft. the well flowed 57 bbl. of 48° oil in 1 hour. This well has also found oil in the Wolfcamp and upper Pennsylvanian.

ILLINOIS

Morris Johnson reports good results with fracturing in the Aux Vases sand which previously look non-commercial in Boos pool, 3 miles southeast of Newton in Jasper County.

Affeld Oil Co. has a new oil pay at 1 Collum, 17-5n-12w, 10 miles south of Robinson in Crawford County. A 1-hour drill-stem test at 1,476-84 ft. in the Cypress sand recovered 1,200 ft. gas, 60 ft. clean oil, 150 ft. slightly mud-cut oil, no water. The wildcat is more than 5 miles from nearest Cypress production.

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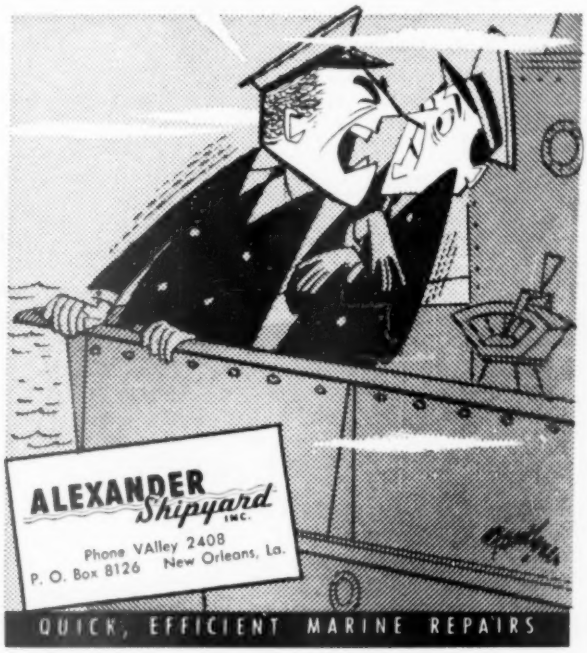

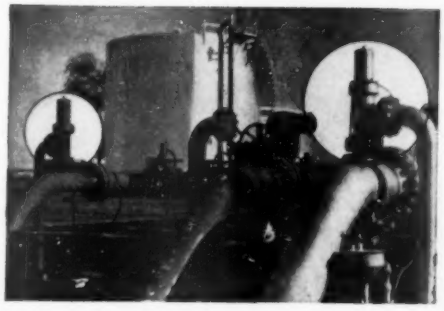

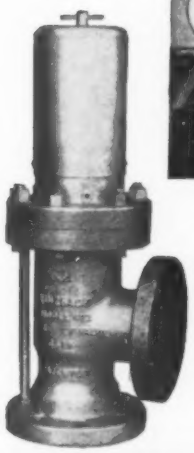

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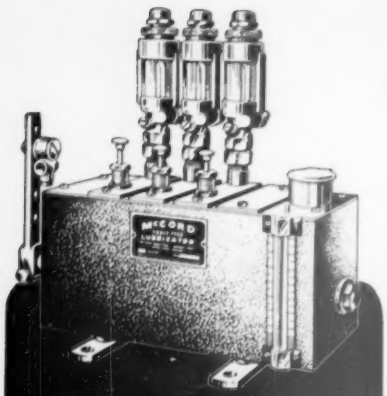

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LUBRICATOR DIVISION

McCORD CORPORATION

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CALIFORNIA

Standard Sets Pipe In Fillmore Test

After redrilling to 14,315 ft. at its wildcat on the Sespe Ranch northwest of Fillmore in Ventura County, Standard Oil Co. of California set 7-in. casing at that depth. Production tests in 1 Sespe Ranch, SW SW 27-4n-20w, were expected to get under way soon.

Spudded last July, the test first drilled to 14,503 ft. Based on showings in this hole it then was plugged back to 13,100 ft. and redrilled to 14,000 ft. From this second hole the well reportedly flowed some condensate and several million cubic feet of gas on a test below 13,900 ft. It again was plugged back and a 9⅝-in. protection string set at 10,997 ft., after which the third hole was drilled to a better structural position.

Texaco Test Swabbing

The wildcat drilled by The Texas Co. near San Juan Capistrano, some 30 miles south of nearest oil production in Orange County, continued to undergo swabbing. The first of last week the contractor was released. Drilled to 7,044 ft., 1 O'Neill estate was plugged back to 4,185 ft. after 7-in. casing was set at 4,341 ft. Location of the rank wildcat is in SE NE 22-8s-7w.

Orchard Pool Extended

Second producer in the Orchard area of Pyramid Hills field, Kings County, has extended production ¼ mile southeast. The test, Norris Oil Co. 52-29 Oceanic-Baylis, reportedly is producing from a shallower Eocene zone than the discovery, however. After flowing 39°-gravity crude from perforations at 3,330-3,480 ft. for a short period, the extensioner died and pumping equipment had to be installed. It is producing from the Point of Rocks sand whereas Reserve Oil & Gas Co.'s discovery in SE SW 20-24s-18e, was completed in the 4,400-ft. Canoas formation.

New Gas Wildcats

Wildcats were getting under way in three northern gas-producing counties. In the Jacinto area of Glenn County, 21-20n-2w, E. L. Doheny was preparing to start 1 Blosser. Humble Oil & Refining Co. 1 Sutter Basin Corp., an 8,000-ft. test, was to drill in 24-13n-2e, in the Robbins area of Sutter County. Standard Oil Co. of California was preparing to start the third test, an extensioner to Thornton field in Sacramento County.

Of the gas tests under way two were those of General Petroleum Corp. in the Sacramento Valley area. In the Saxon area of Yolo County, 1 Glide-Court was drilling below 11,728 ft. Near Beehive Bend field of Glenn County, its 1 Kimjones was drilling below 5,346 ft.

New Imperial Valley Test

The Texas Co. has renewed its search for oil in Imperial Valley with the staking of a test near Twenty-Nine Palms in Riverside County. The new wildcat, labeled 1 Stone, will be in 25-3s-5e. In the winter and spring of 1951-52 the company drilled four tests, ranging in depth from 4,400 to 8,600 ft., in the southern portion of the valley. No shows of any significance were reported in any of them.

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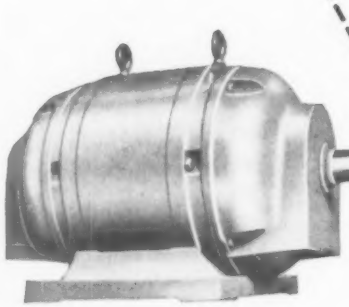

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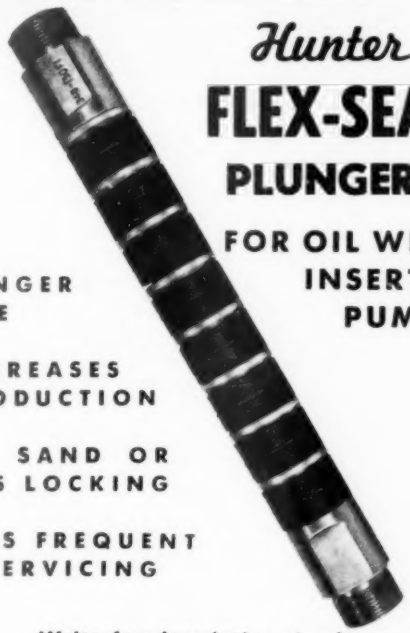

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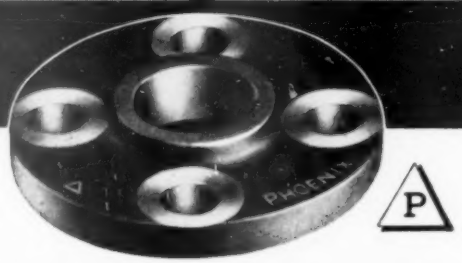

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CITIES SERVICE

ROCKY MOUNTAIN

NORTHERN NEW MEXICO

Continental Starting Raton Basin Program

Continental Oil Co. has announced the first in a projected series of six wildcats through the Raton basin in northern New Mexico and southern Colorado. The first test will be to Magdelena (Pennsylvanian) at about 7,000 ft. Location for 1 St. Louis, Rocky Mountain & Pacific Co. is NW SW NE 35-31n-21e, about 12 miles west of Raton in Colfax County, New Mexico.

A part of the six well program will be to Dakota, according to the operator. Continental has a block of about half a million acres in the New Mexico portion of the basin, with adidtional holdings on the Colorado side. The company has recently completed a core drill and geophysical program through a part of the area held.

There has been no commercial production established in the Raton basin, and it has had very little exploration during recent years.

ARIZONA

Tests to Start at Apache County Wildcat

Shell Oil Co. has plugged back and is preparing to start tests of Hermosa at 1 Navajo, C SE SE 6-41n-29e in the northeastern corner of Apache County. The wildcat, just south of the Utah border and east of Boundary Butte field had shows through this formation which indicated a possible commercial completion as the first producer in the state.

Top of Hermosa was reported at 4,020 ft., and Molas at 5,410 ft. Oil and gas cut mud, and gas recoveries ranging up to a rate better than 100,000 c.f.p.d. were found on tests through Hermosa.

NEVADA

Shell Drilling Ahead at Apparent Discovery

Shell Oil Co. is drilling below 7,362 ft. at 1 Unit, SE NE NW 35-9n-57e, in the Eagle Springs area of Nye County. No recent shows of consequence have been reported, although Shell reported shows of varying caliber from about 6,400 ft. to 6,970 ft. The well is believed likely to become Nevada's first producer on the basis of tests previously run.

Meanwhile, leasing in the Reno land office, which is reported to have received applications for lease one more than three million acres of federal land since the Shell shows were announced, has receded slightly. Operators, particularly in the Rocky Mountain area and in California have landmen, scouts and geologists in the state. Geophysical activity is also reported rising steadily.

NEBRASKA

Dawes County Wildcat Testing

Cree Drilling Co.'s important wildcat, 1 State, C SE SE 16-29n-49w, 25 miles south of Chadron in Dawes County is being tested. The well went to a total depth of 5,008 ft. and casing was landed at 4,400 ft. The well has been plugged back for tests. Three sand zones of Permian (?) age showed possibilities of production when logged, and the well will be perforated uphole for thorough testing.

Meanwhile, Shell Oil Co., holder of the farmed out acreage on which the Cree well is located is operator of a second wildcat in the area. The company reached 3,190 ft. at 1 State, SE SW SE 16-29n-49w, before being temporarily shut down by blizzard conditions.

COLORADO

Logan County Wildcat Is Gas Discovery

Ryan Oil Co. recovered gas at the rate of 4,000 M.c.f. per day on two tests at 3 State, SW SW SW 16-8n-54w, Logan County. Test of the zone 5,348-57 ft. flowed at the 4,000 M.c.f. rate after 3 minutes. A test 5,357-78 ft. flowed at about the same rate, but recovered some water. The operator is continuing tests.

Two New Permian Tests Located

Two new wildcats in Weld County on the west side of the Colorado portion of the Denver-Julesburg basin will test the Lyons (Permian) sand. William R. Whittaker Co., Ltd,. of Los Angeles will drill 1 Klausner, NW NW SE 33-1n-62w, about 12 miles south of Roggen and west of an 8,413 ft. dry hole

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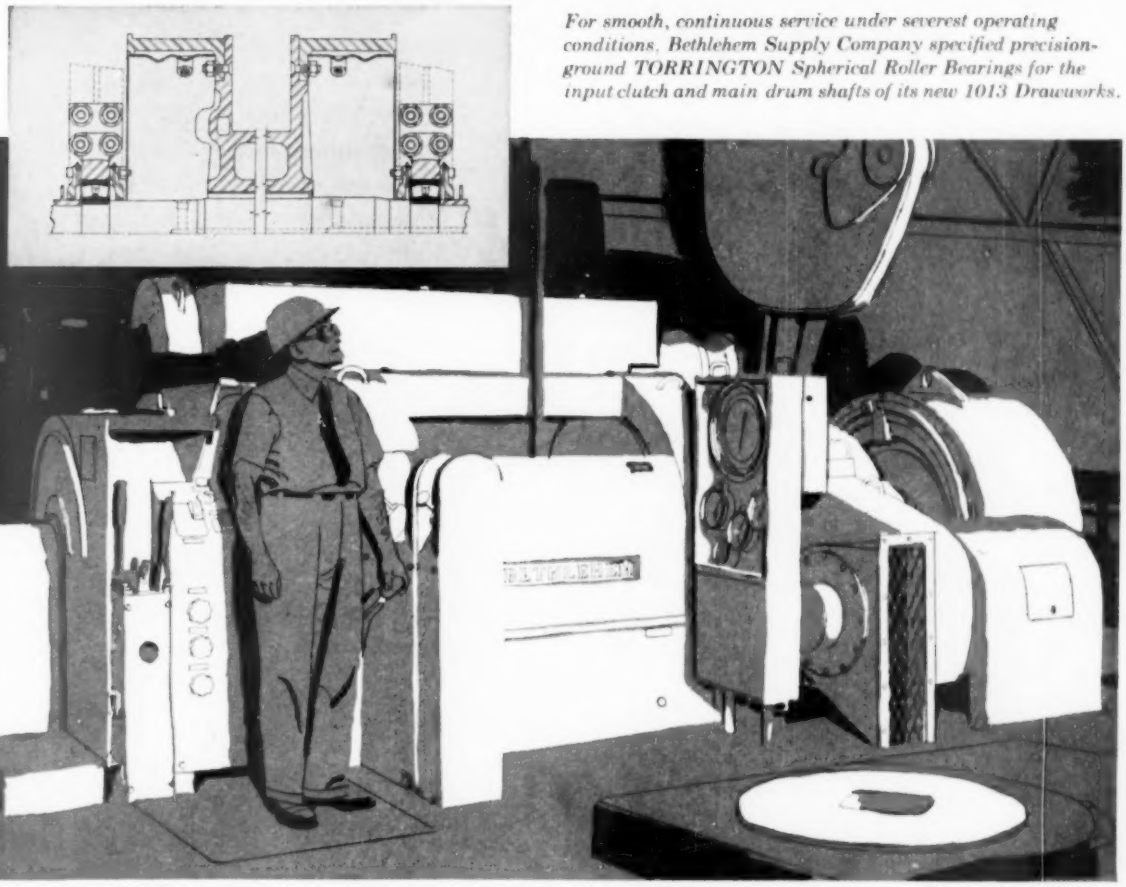

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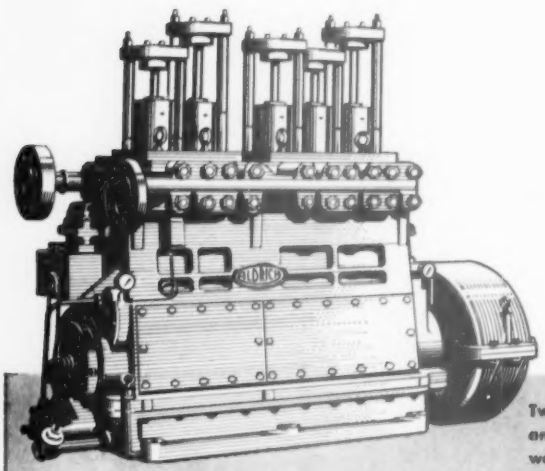

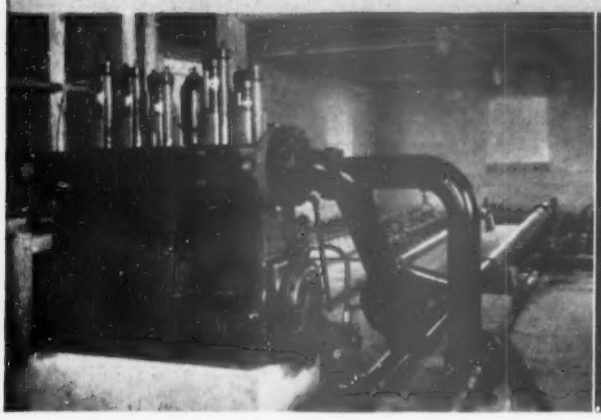

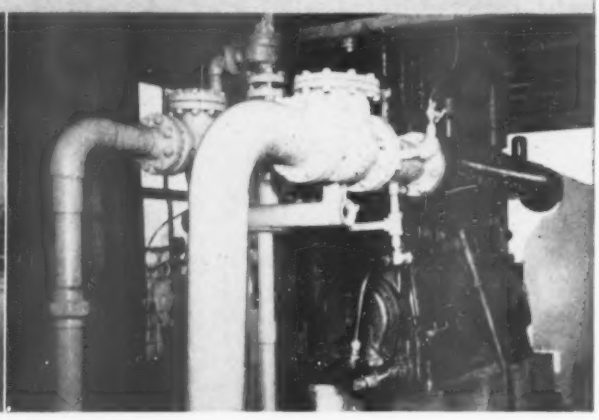

Two Aldrich Direct Flow Pumps on the job on water flood operations. At left is an Aldrich 3" stroke motor-driven Quintuplex Pump used for pumping salt water at the Osage #2 property of Winona Oil Company, Flat Rock, Okla. On the right is an installation at Skiles Oil Company, Mt. Carmel, Ill., where a similar Aldrich unit pumps fresh water at 120 gpm against 1450 psi.

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drilled by this operator in 1953. British-American Oil Producing Co. has made location for 1 Henrich, SE SE SE 14-7n-61w, about four miles south of Greasewood field.

Exploration to deeper zones through the basin has been steady but not at a high level since the flurry which followed the initial discovery of Lyons production in Keota field early in 1953. The California Co.'s success in the Black Hollow area of Weld County is the only field opened up from Permian since the Keota discovery.

Prowers County Deep Test Abandoned

Terminal Facilities, Inc. (Cities Service) has abandoned 1 Holt "A," NE NE SW 6-26s-43w, Prowers County, following extensive acidizing and testing in pre-Cretaceous formations. Total depth of the well is 5,500 ft. Casing was landed on bottom for testing.

WYOMING

Fourteen Mile Creek Wildcat Is Failure

Gulf Oil Corp. has abandoned 1 Butler-Federal, C SE NW 35-47n-94w, in the Fourteen Mile Creek area of Washakie County. The well went to a total depth of 13,182 ft. Shows were logged in Phosphoria, but drill-stem test recovered only slightly gas-cut water from the zone 13,125-13,182 ft. The well is the first completion in the area since discovery of deep Phosphoria production in the general area by Gulf in 1951.

Four miles east of this failure, Gulf is running tests at 1 Teeters, C SE NW 28-47n-93w. Casing was landed at 12,150 ft. in the 12,206 ft. hole. Cores in Phosphoria recovered dolomite, bleeding gas and oil with a strong odor of sulfur. No test data has been released.

Big Horn County Discovery Testing

A swab gage of 71 bbl. of oil in 2 hours was reported by Sohio Petroleum at 1 Standard-Wambeke, C SW NW 31-57n-97w, in the North Byron area of Big Horn County. Production is from Phosphoria and tests are recovered on drill-stem tests of Phosphoria at 5,233-62 ft. The disc. is about 2½ miles from production in the North Byron area.

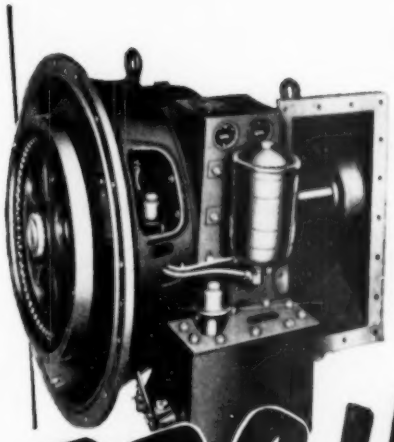
Green River Basin Wildcat Staked

General Petroleum Corp. has made location for 1 Unit, SW SW SE 24-14n-101w, first test of the East Salt Wells Unit in Sweetwater County. The wildcat will test to Lewis shale at about 6,000 ft.

NORTH DAKOTA

Amerada to Try Heath Completion at Fryburg

Amerada Petroleum will attempt a commercial completion in Heath sandstone at 1 Cheadle, SE NW 9-139n-100w, Billings. Tests were run in Madison which is the producing horizon in all wells completed to date in Fryburg field, but they were not encouraged. This well, like several others in the area had substantial Heath shows.



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TEXAS

WEST TEXAS

Tom Green County Discovery is Completed

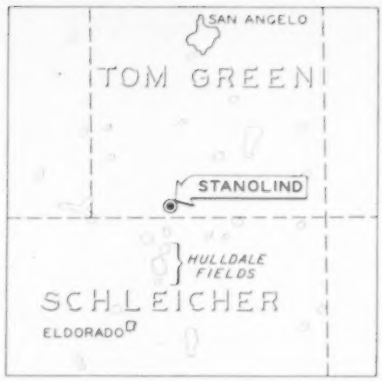
A new Strawn reef pool has been opened in southern Tom Green County by Stanolind Oil & Gas Co. at 1 Hoblet-Jacobs Ranch Co. Location of the new strike is 5 miles south of Christoval, and importance of the well is the possibility of its opening a new area comparable to the prolific Hulldale fields directly south of it, but in Schleicher County.

Completion potential on Stanolind's well was 242 bbl. of 41° oil a day through 12/64-in. choke. Top of the Strawn reef was picked at 5,348 ft. on elevation of 2,126 ft., and pay perforations were from 5,502-12 ft. Completion was without acid treatment and water content was zero.

Stanolind 1-G Johnson, deep test north of Canyon production in Pecan Station pool, found the Ellenburger dry between 5,851-5,902 ft., and was drilling ahead to run tests in the Cambrian. Top of Cambrian sand, by samples, was 6,032 ft. and first test was scheduled between 6,032-47 ft.

Cambrian search . . . As a result of successful wells in the Cambrian formation in Nolan County, many new tests have been projected to that formation, where formerly they were given up when the Ellenburger was dry. The intense interest shown in Cambrian production has also made most every old Ellenburger failure, and some producers, a target for redrilling, or at least for restudy of logs, tops, etc.

In line with this new thinking, Taylor Oil & Gas Co., San Angelo, and G. L. Rowsey have staked location for a Cambrian wildcat in eastern Schleicher County. The proposed test will be 1 Sheen Brothers, to be drilled to 6,000 ft., and location is just west of a new Strawn reef gas discovery. The latter gas well was Carter & Carter 1-A Sheen, which had gas pay at 4,411-25 ft. Gas and distillate have been found in the Ellenburger, in the same area.



Third well high on reef . . . The Texas Co. 2 Clayton "B," northwest offset to the firm's discovery of Northwest Good field, Borden County, reported top of the reef pay section to be 159 higher than in its discovery. A drill-stem test from 7,916-8,030 ft. had flowing oil in 20 minutes and gaged 169.78 bbl. of oil in 2 hours through 1-in. top and bottom chokes. No. 2-B Clayton is third well for the field.

Gaines discovery completed . . . Rowan Oil Co. and Southland Royalty Co. 1 Stanton Brunson has been completed for a daily potential of 1,868 bbl. of oil. Final gage was based on a 6-hour flow of 467 bbl. through ¾-in. choke, from Devonian pay at 12,674-12,728 ft.

Yoakum County extension . . . Felmont Oil Corp. 1 Kendrick, 1 mile south of present production in Bronco field, has been completed for 1,147 bbl. of oil a day from the Devonian at 11,735-11,785 ft. Top of the Devonian was 11,735 ft. on elevation of 3,802 ft.

Location of the new extender is in Section 455. It is separated from the field by a Wolfcamp producer which was dry in the Devonian, and may be on a separate structure.

Following successful completion of 1 Kendrick, Skelly Oil Co. filed application to drill 1-A Kendrick as an east offset to Felmont's well.

SOUTHWEST TEXAS

Designations Listed for South Texas Discoveries

Seven recent discoveries in Southwest Texas and the Lower Gulf Coast area have been assigned official nomenclature designations. The discoveries, their county location, and their respective discovery wells follow:

Fulton Beach, North (A-3), Aransas, C. G. Glasscock and Humble Oil & Refining Co. 3 State Tract 9; DeSpain, South (Bruni sand), Webb, Dulaney Oil Co. 1 Welhausen; El Benadito (20-D sand), Starr, Kirby Petroleum Co. 1-A Brannan; Fulton Beach, North (C-1), Aransas, C. G. Glasscock and Humble Oil & Refining Co. 1 State Tract 8; Robstown, East (Wood sand), Nueces, Arnold O. Morgan 1-28

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Wood; Meehan (Frio sand), San Patricio, Jake L. Hamon et al 1 Meehan; Seventy-Six, West, Duval, The Texas Co. 2-A DCRC NCT-12.

Aransas County Wildcat Uncovers New Frio Pool

Flowing production at the rate of 70 bbl. of oil per day was recorded in tests through ⅛-in. choke at Heep Oil Corp. and associates' new discovery well, 1 Rouquette & Wendall, 2 miles west of Rockport in Aransas County. Gas flow was not reported, but high gas-oil ratio was indicated. Flowing pressure gaged 1,500 psi.

Testing continues with producing zone in Frio sand, perforated at 8,284-90 ft. Total depth is 8,300 ft.

The discovery is 3½ miles southwest of Salt Lake field, and about 5½ miles southwest of the widespread West Fulton Beach field.

In view of the discovery, Renwar Oil Corp. is deepening a 7,502-ft. dry hole, located 3,840 ft. northeast (between the discovery and Salt Lake field), and will carry it through the pay zone of the Heep well. The hole, 1 Bailey, was drilled in 1952 by Selby Walker and Joseph Dawson.

Sullivan City Discovery Opens Two Pay Horizons

Clark Fuel Co. and K. D. Owen have a new gas-condensate discovery in the Sullivan City area, of Hidalgo County, in the Rio Grande Valley, where their 1 Nives Ramirez is being completed dually in Frio sands at 5,254-66 ft. and 6,016-38 ft.

No estimate of productivity was reported pending potential tests. The upper zone was cleaned through 3/16-in. choke with flowing pressure of 1,500 psi. A drill-stem test of the lower zone flowed gas and condensate with 44 psi. pressure through ¼-in. choke.

Location, a mile northeast of Sullivan City, is east of oil production at the northeast edge of Sullivan City field.

Calallen Gets Deeper Pay

Discovery of a new oil-producing sand in Calallen field, Nueces County, is reported by Phillips Petroleum Co. and Rock Hill Oil Co., joint operators. Discovery well is their 1 Wood, completed from Frio pay at 8,360-22 ft., 1,000 ft. deeper than previous production found in Phillips' 1 Myron, 960 ft. to the northeast, completed in a 7,350-ft. sand. The new well flowed 209.8 bbl. of oil per day on tests through 9/64-in. choke with tubing pressure of 2,800 psi.

TEXAS PANHANDLE

Roberts Extension Well Is Completed

Phillips Petroleum Co. 1-B Clark Mathers, 1-mile southeast extension to production on the southwestern side of Roberts field, has been completed for 184 bbl. of oil a day. Potential was through ½-in. choke on perforations from 4,121-26 ft.

In Hansford County, R. H. Fulton et al 1 Evans, northeast of East Gruver gas field, prepared to test the Strawn through perforations at 6,305-21 ft. Last week this well developed a flow of gas on drill-stem test at 6,241-6,301 ft.

LOUISIANA

NORTH LOUISIANA

Liberty Hill Discovery Completed in Bienville

Placid Oil Co. has completed the discovery well of new Liberty Hill field in eastern Bienville Parish, northwestern Louisiana.

The 1 Southern Advance Bag & Paper Co., Inc., et al flowed an estimated 4,000 M.c.f. of gas per day through ¼-in. choke. The Travis Peak gas was dry. The strike lies in 8-15n-5w, 2¼ miles south of Liberty Hill, and 3 miles east of Lucky field. The pool opener has production from about 14 ft. of net gas sand in the Travis Peak.

SOUTH LOUISIANA

Second Producer Confirms Anse La Butte Discovery

Recent discovery of deep oil production on the east side of Anse La Butte salt dome, in St. Martin Parish, has been confirmed with completion of the second well.

The new well, which also produces from a different pay zone, 200 ft. shallower, than that in the discovery well, is Warren Petroleum Co.'s 2 Alexis Voorhies.

On potential gage, it flowed at the rate of

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642 bbl. of 33.3°-gravity oil per day. Flow was through 14/64-in. choke with tubing pressure of 1,675 psi. Gas-oil ratio measured 769 cu. ft. per barrel.

The new area was discovered late last year by Warren's first well on the same lease. It had a potential flow of 493 bbl. of oil per day through 12/64-in. choke, with pay interval at 8,678-81 ft. Neither well showed any formation water.

Church Point Production Extended Mile Eastward

Pan American Production Co. has added another major extension to the already widespread Church Point gas-condensate field, in Acadia Parish.

This company's 1-B Daigle, in 77-8s-2e, a mile east of production, is rated good for 265 bbl. of 49°-gravity condensate and 5,899,000 cu. ft. of gas daily on ¼-in. choke with 4,000 psi. pressure on the tubing.

Also completed is another well on the southwest side of the field by Union Sulphur and Oil Corp. at its 1-A Daigle, flowing 36 bbl. of 54.2°-gravity condensate with 1,300,000 cu. ft. of gas daily through 9/64-in. choke under 3,250 psi. pressure.

Pan American's well produces from sand interval at 10,975½-94 ft. Union Sulphur's well is at 10,160-80 ft.

Pan American and Union are the major developers in the area, discovered by the latter in November 1952. The area is 2 miles west of Church Point.

Pipe Testing on Location with WISCONSIN-Powered Truck Rig

This ingeniously designed rig, powered by a model VF4- V-type 4-cylinder Wisconsin, makes pressure examinations of casing and tubing on location in the field. Pipe Tester unit is built by McFarland Mfg. Co., Houston, Tex.

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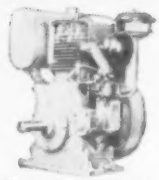
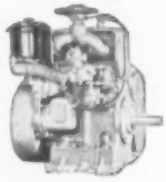
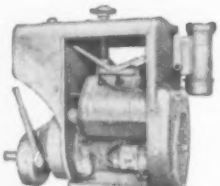

4-cycle Single Cylinder 3 to 9 hp.


2-cylinder 7 to 15 hp.


V-type 4-cylinder 15 to 36 hp.

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WILDCAT COMPLETIONS

SOUTHWEST TEXAS

Atacosa County: Texas Crude Oil Co. 1 Benz, William Moore Sur. 897, A-629. Dry. TD 7,290 ft.

Duval County: Blanco Oil Co. and Killam & Hurd 1 Southland, Lot 4, Ball Ranch, Agua Poquta Sur., A-213. Dry. TD 4,825 ft.

H. R. Smith 1 Denman, Lot 6, Section 85, Copia Farm & Garden Tracts, Certificate 5. Dry. TD 5,875 ft.

Gonzales County: Sutton Drilling Co. 1-C Robinson, J. Tumlinson Sur., A-74. Shut down. TD 2,238 ft.

Hidalgo County: The Texas Co. 1 McAllen-NCT-2, Santa Anita Sur., A-63. Dry. TD 7,515 ft.

Jim Wells County: Appell Oil & Gas Corp. 1 George est., Lavaca Grant Sur., A-166. Dry. TD 5,410 ft.

McMullen County: Plymouth Oil Co. 1 Henry, Section 10, Two Rivers Subd. Dry. TD 1,135 ft.

Nueces County: A. O. Morgan and W. E. Fox 1 Cooper, Section 28, Paul Subd., Driscoll Ranch. Dry. TD 7,517 ft.

San Patricio County: Austral Oil Exploration Co. and Arkansas Fuel Oil Co. 1 Green est., Reuben Ross Sur., A-227. Dry. TD 9,025 ft.

George W. Graham 1 Hutchins & Stillwell, T. T. Williamson Sur. 43, A-290. Dry. TD 9,515 ft.

Travis County: E. R. Marts 1 Eppright, Barker Sur. Dry. TD 530 ft.

Webb County: W. L. Cotton, Inc., and L. G. Shelly 1 Benavides, SK&K Sur. 1088. Dry. TD 2,600 ft.

TEXAS GULF COAST

Bee County: Morris Cannan 1 Knight, Thomas B. Barton Sur., A-83. Dry. TD 7,414 ft.

Siznod Oil Corp. 1 Booe, Thomas Mancha Sur., A-225. Shut down. TD 6,086 ft.

Skelly Oil Co. 1 Anderson, Section 13, Theodore Plummer Subd., Lott Lands, T. J. Smith Sur., A-525.

Brazoria County: Continental Oil Co. 1 State, Tract 5, in San Bernard River (Allen dome). Dry. TD 4,500 ft.

Hardin County: Ted Weiner and Arthur Wellman & Sons 1-A Kirby, James Stephenson Sur., A-444. Dry. TD 7,378 ft.

Jackson County: Holmes Drilling Co. 1 Drushel, Lot 3, C. H. Hahl Subd., Harwood-Burns Ranch, Elizabeth McNutt Sur., A-46. Dry. TD 6,912 ft.

Thomas Jordan, Inc., 1 Strane, Section 32, William B. Bridges Sur., A-9. Dry. TD 5,005 ft.

H. J. Porter et al 1 Stockton est., J. T. White Sur., A-339. Dry. TD 5,606 ft.

Karnes County: Lone Star Producing Co. 1 Moore, J. Priest Sur., A-228. Dry. TD 7,976 ft.

Live Oak County: Kirkwood & Co. 1 Marrs McLean est., Louis Romero Grant, A-395. Dry. TD 7,015 ft.

Matagorda County: Stanolind Oil & Gas Co. 1 Sanborn, S. William Sur., A-106. IP 13,500 M.c.f. daily plus condensate (no gage), perforations 13,048-68 ft. TD 16,120 ft. (New field).

Montgomery County: Humble Oil & Refining Co. 1 Grand Lake Gas Unit 2, Ransom House Sur., A-245 (Grand Lake area). Dry. TD 11,300 ft.

Refugio County: Reynolds Mining Corp. 1 Welder heirs, James Power and James Hewitson Sur., A-54. Dry. TD 6,500 ft.

Tyler County: Humble Oil & Refining Co.

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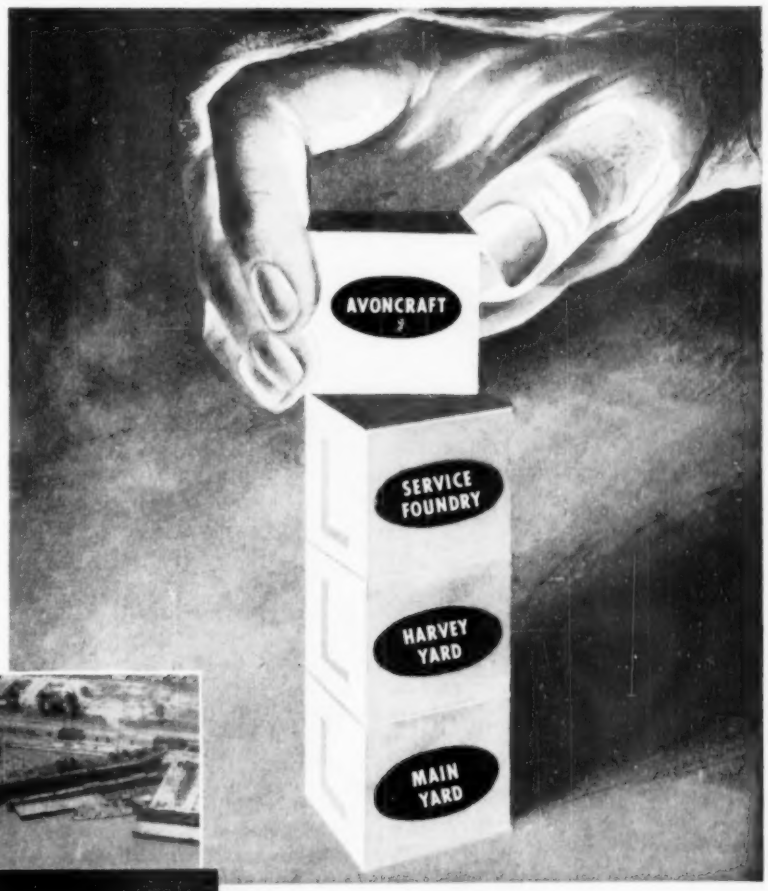

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WILDCAT COMPLETIONS

I-D William Rice Institute, T. Farmer Sur., A-266. Dry. TD 8,177 ft.

Walker County: R. W. Ramey and Texmo Oil Co. 1 Kmiecik, Samuel Lindley Sur., A-29. Dry. TD 4,560 ft.

Wharton County: N. B. Hunt 1 Fenner, Lot 42, H&TC Sur. 45, A-209. Dry. TD 4,810 ft.

EAST TEXAS

Cherokee County: Sunray Oil Corp. 1 Chiles, Wm. George Sur., A-295. Dry. TD 9,198 ft. Elev. 480 ft., Pettit 8,453 ft., Travis Peak 8,665 ft.

Houston County: D. D. Feldman Oil & Gas Co. 1 Maples, Barton Clark Sur., A-23. Dry. TD 9,514 ft.

Rains County: Shell Oil Co. 1 Homer Bishop, R. Hotchkiss Sur., A-119, 4 mi. E Emory, ½ mi. NE Carraway 1 Puckett. Dry. TD 12,599 ft. Elev. 470 ft., Cotton Valley 9,461 ft.

Rusk County: Pan American Producing Co. 1 Turlington, Thomas O'Bar Sur., A-26, 5 mi. SW South Hallsville field. IP 30 BOP, ¼-in., 40°, Travis Peak transition zone 6,988-7,004 ft.; IP 3,000,000 cu. ft. gas, Travis Peak 7,144-63 ft. TD 7,173 ft.

TEXAS PANHANDLE

Armstrong County: Texas Crude Co. 1-142 Riley, SE NE Sec. 142, Blk. 4, H&GN Sur. Dry. TD 5,040 ft.

Roberts County: Underwood 1 Seider, NE NE Sec. 15, I&GN Sur. Dry. TD 4,225 ft.

WEST CENTRAL TEXAS

Callahan County: U. S. Epperson Underwriting Co. 1 Dyer, 92-12-T&P. Dry. TD 4,677 ft.

Woodson Producing Co. and Callihan Rotary Co. 1 Cutbirth, Bartola Carcia Sur. 204. Dry. TD 2,200 ft.

Coleman County: Gore Drilling Co. 1 McCord, Sec. 25, BS&F Sur. Dry. TD 4,050 ft.

Eastland County: Justrite Drilling Co. 1 Davenport, 8-4-H&TC. Dry. TD 2,205 ft.

Sorrells Oil Co. 1 Smith, 17-1-H&TC. Dry. TD 3,375 ft.

Frank W. Young 1 Ballew, 11-2-ETRR. Dry. TD 1,585 ft.

Haskell County: Ab-Tex Drilling Co. 1 Hutchens, Red River CSL Sur. Dry. TD 5,872 ft.

Hack Drilling Co. 1 Burson, 220-45-H&TC. Dry. TD 5,900 ft.

Thos. D. Humphrey & Sons 1 Atchison, GH&H Sur. 2. Dry. TD 5,346 ft.

Thos. D. Humphrey 1 Darden, J. N. Gainer Sur. 54, A-142. Dry. TD 5,495 ft.

Edward C. Lawson 1 Grissom, McHenry Winburn Sur. 21. Dry. TD 5,637 ft.

Russell Maguire 1 Swenson, Sec. 8, J. W. Nabors Sur., A-513. Dry. TD 5,360 ft.

Jones County: American Trading & Producing Corp. 1 Roberts, Sec. 26, OAL Sur. Dry. TD 2,925 ft.

C. M. Ashby 1 Poe, 14-17-T&P. Dry. TD 5,250 ft.

Geochemical Surveys 1 Manly, 42-14-T&P. Dry. TD 2,505 ft.

Geochemical Surveys 1 Tarpley, Sec. 94, DeWitt CSL Sur. 125. Dry. TD 2,930 ft.

P. G. Lake, Inc., 1 Williams, 36-1-BBB&C. Dry. TD 3,867 ft.

E. L. Wilson 1 Brockett, 100-1-BBB&C. TD 3,145 ft.

Nolan County: J. D. Wrather 1 Gooch, 169-64-H&TC. Dry. TD 6,236 ft. Elev. 2,232 ft., Ellenburger 5,803 ft., Cambrian 6,214 ft.

Palo Pinto County: W. T. Waggoner 1 Watson, 16-2-T&P. IPP 49 BOPD, pay 1,084 ft. TD 1,090 ft.

Shackelford County: U. S. Epperson Underwriting Co. 2 Hendrick, Sec. 181, ETRR Sur. Dry. TD 4,924 ft.

West Central Drilling Co. 1 Walker-Buckler, 62-13-T&P. Dry. TD 5,000 ft.

Stephens County: Ab-Tex Drilling Co. 1 Carey, 82-6-T&P. Dry. TD 3,836 ft.

J. E. Connally 1 Wagley, 25-7-T&P. Dry. TD 3,959 ft.

Taylor County: Allison & Prestridge 1 Hensley, 119-64-H&TC. IP 101 BOPD, 45°, 22/64-in., Fry sand 5,172-78 ft. TD 5,289 ft.

W. E. Butler 1 Wagstaff, J. H. Kleberg Sur. IPP 80 BOPD, 39°, Flippen lime 2,361-67 ft. TD 4,800 ft.

Haynes B. Ownby Drilling Co. 1-A Irvin, 24-18-T&P. Dry. TD 4,842 ft.

Throckmorton County: Howsley & Jacobs 1 Matthews, 227-10-ETRR. TD 1,820 ft.

Shamrock Oil & Gas Corp. 1 Brown, Sec. 1195, TE&L Sur. Dry. TD 4,356 ft.

Warren Petroleum Corp. 2-A Cochran, Sec. 2318, A-670, TE&L Sur. Dry. TD 4,743 ft.

NORTH TEXAS

Archer County: F. T. Johnson 1 Wright, Blk. 16, W. E. Probert Sur. IPP 22 BOPD, Cisco 1,454 ft. TD 1,459 ft.

Scott Bros. 1 Kinder, Blk. 53, Lot 5, Clark & Plumb. Dry. TD 1,260 ft.

Scott Bros. 1-B Kinder, Blk. 46, Lot 5, Clark & Plumb. Dry. TD 1,282 ft.

Harry F. Snebold 1-A White, 12-41-ATN-CL. Dry. TD 1,497 ft.

Baylor County: Moncrief & Wiley Oil Co. 1 Hargrave, TE&L Sur. 3141, A-547. Dry. TD 1,550 ft.

Clay County: W. A. and E. R. Hudson 1 Schmittou, Blk. 39, Freestone CSL, A-144. Dry. TD 5,950 ft.

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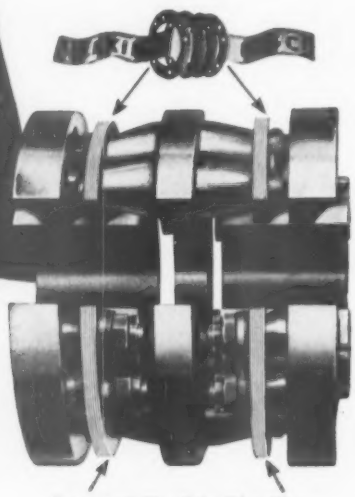

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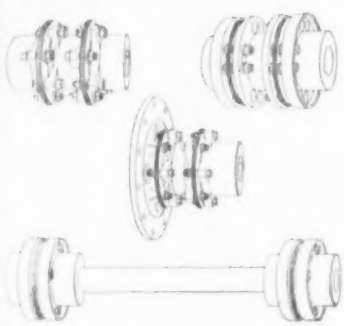

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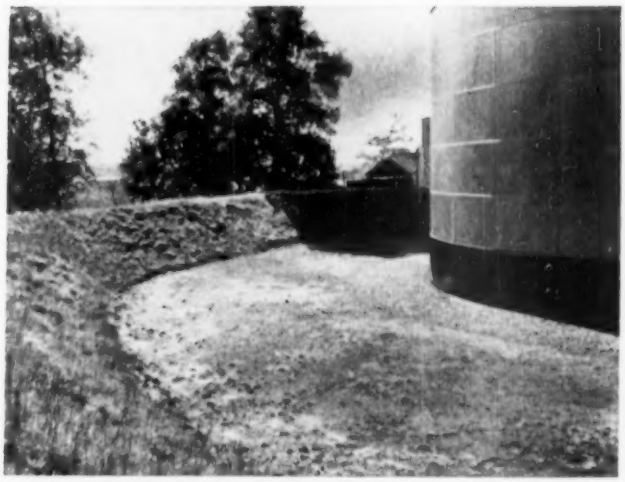

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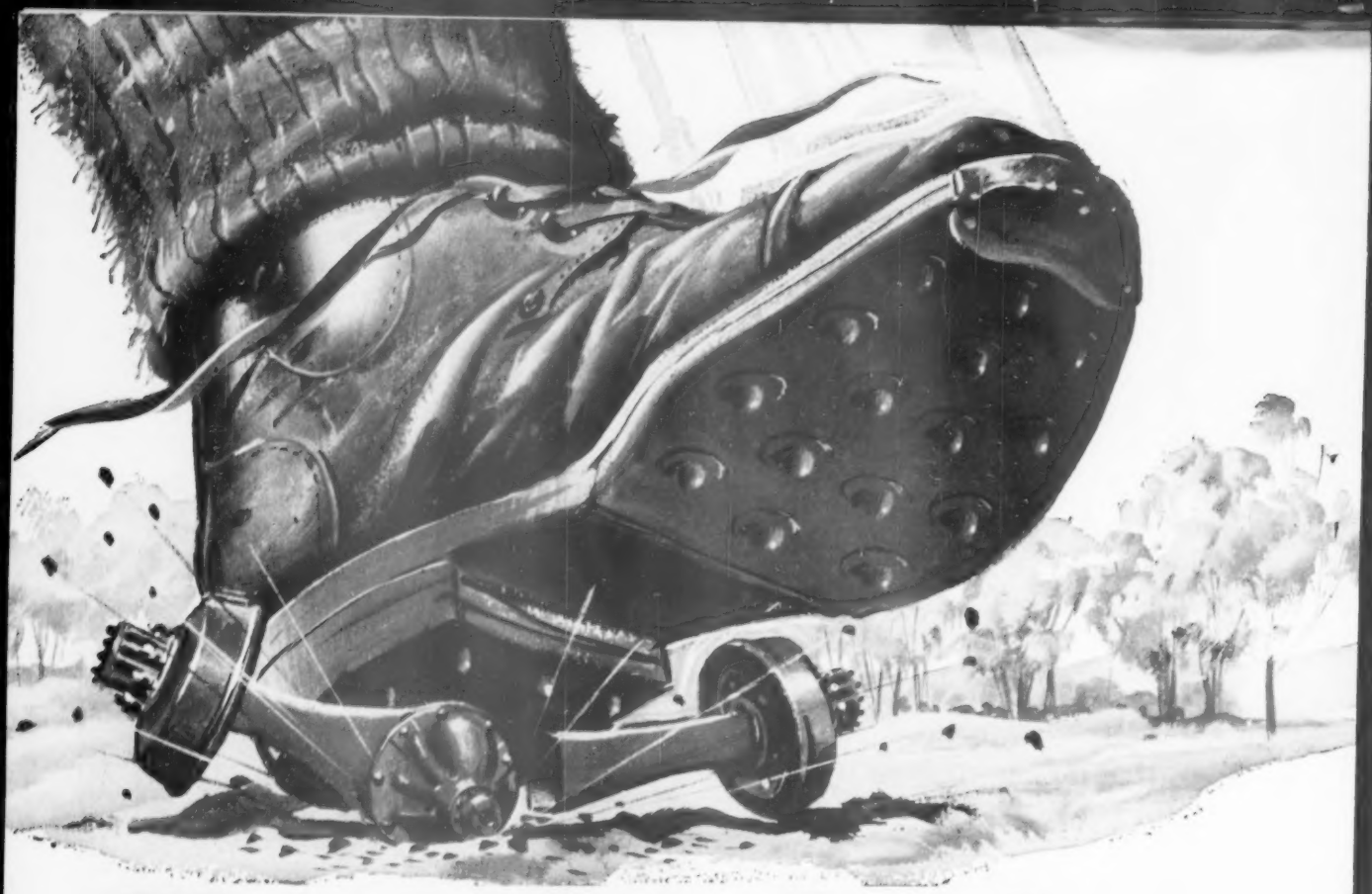
On all chemicals always follow directions for application. Where warning or caution statements on use of the product are given, read them carefully.



We grind truck axles to

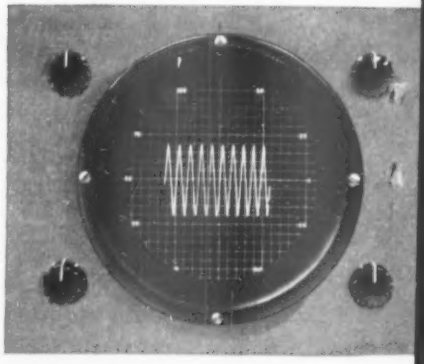
in the new Timken-Detroit indoor proving ground . . . and only

We jounce, twist and grind them. We abuse, torture and ruin them. We duplicate any on-the-job hauling situation... then add several special brutal tests of our own.

And for good reasons! We can assure you in advance that a Timken-Detroit axle can take a harder beating on the job it was built for than any other axle made!

We capsuled a multi-thousand acre proving ground into one room. Here our engineers put 50 years of experience in building axles for trucks, buses and trailers to work. Here the axles and gearing are subjected—*indoors*—to any *outdoor* hauling condition . . . and scientifically analyzed.

It's research to the "umpteenth" degree. But *you* enjoy: longer truck life; less maintenance, repairs and downtime; lower operating costs. That's why the smart money of truck builders and owners rides on Timken-Detroit axles and gearing.



Whatever you haul . . . simulated service conditions show up electronically on a screen like this. For instance—a heavily loaded truck on a bumpy, twisting road—then on a level express highway or long grade. What happens to the axle and gearing is measured, charted with absolute scientific accuracy.

TDA proves axle quality and performance in this "Torture Chamber"

Here we simulate actual highway conditions . . . test quality and performance of axles under any hauling situation, such as duplicating the kinetic energy of 80,000 lbs., G.C.W., at 60 m.p.h. All tests are repeated hour after hour with an automatic cycling control.

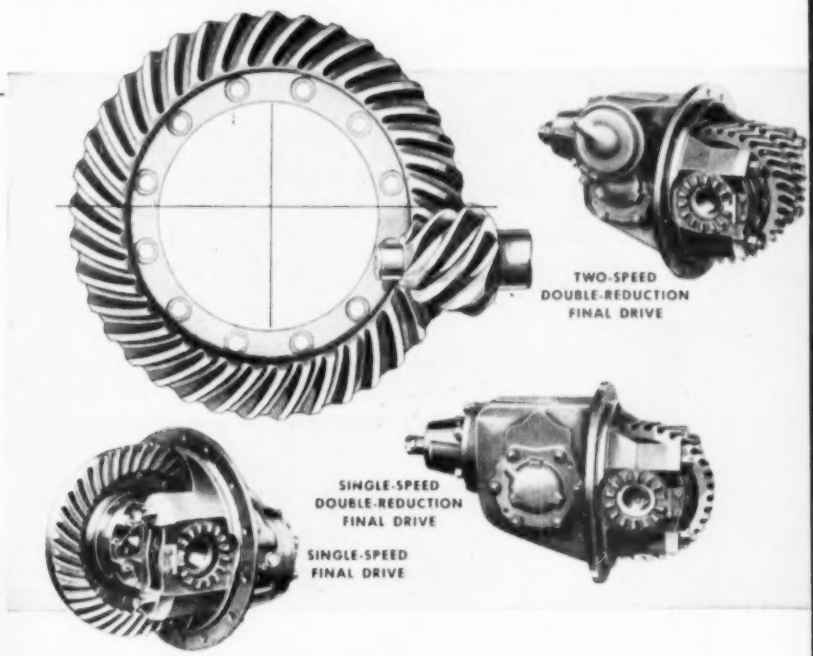
You're hauling machinery . . . you want axles that stand extreme stress and strain. You want speed where it counts . . . power where necessary . . . economical engine operation. You want easy, low-cost maintenance . . . scant repair and downtime . . . long, profitable truck life. Your answer is Timken-Detroit "Torture-Tested" axles with Hypoid gearing.

You're hauling pipe . . . you want axles that can "tote" the load – on highway, side roads and open fields . . . can do it fast, powerfully, dependably. You want axles that absorb punishment . . . are easy and cheap to maintain . . . stingy on repairs and downtime. You want Timken-Detroit "Torture-Tested" axles with Hypoid gearing – the best!

You're hauling gasoline . . . you want axles that can make "knots" on highways . . . eat up grades . . . take stop-and-go hauling in easy stride. You want engine economy . . . low maintenance expense . . . little downtime . . . few repairs . . . long truck life. You want something special – Timken-Detroit "Torture-Tested" axles with Hypoid gearing!

pieces

Timken has it!



TIMKEN Detroit AXLES

TIMKEN-DETROIT AXLE DIVISION
ROCKWELL SPRING AND AXLE COMPANY
DETROIT 32, MICHIGAN

The Accepted Standard — TRADE MARK REGISTERED

"TORTURE-TESTED"
to Save Money on the Job

WORLD'S LARGEST MANUFACTURERS OF AXLES FOR TRUCKS, BUSES AND TRAILERS

Next truck you buy . . .
insist on Timken-Detroit Hypoid gearing

Hypoid gearing for truck axles was pioneered by Timken-Detroit.

Proved in billions of ton-miles of actual operation. Designed to give the slower gear ratios necessary for modern engines without loss of strength. Pinion is bigger, stronger . . . bearings are larger . . . more teeth in contact reducing loading per unit of contact area. Torque transmitting capacity increased to step up performance and rugged power.

Get 3-for-1 power, too! . . . tailor-make your truck to the job with a choice of three final drives – single-speed; single-speed double-reduction; and two-speed double-reduction. They fit into any one of a complete "family" of 7 basic axle capacities – in the entire range of medium and heavy-duty requirements. This advanced-related design incorporates identical features of construction and interchangeability.

Plants at: Detroit, Michigan
Oshkosh, Wisconsin • Utica, New York • Ashtabula, Kenton and Newark, Ohio • New Castle, Pennsylvania

There's never been anything like

LAUGHLIN'S Load Binder

BRAND NEW
new design, new economy, new convenience.

MORE USEFUL
one binder does the work of two.

GREATER SAFETY
drop forged strength plus non-slip locking.

HERE'S THE STORY:

The new LAUGHLIN LOADBINDER is a sturdy, drop forged, heat treated steel unit available in two sizes, each of which can use four different hook sizes. You buy only **one** handle assembly, attach two Laughlin clevis grab hooks to fit your chain. Change hooks in a jiffy with pliers or screwdriver.

Stronger, too, because swivel tongue swings on end of slotted jaw, won't spread under strain. Safe, because a positive cam lock action keeps it shut.

#1 Binder: U.T.S. 22,000 Lbs. Hook sizes: ¼", ⅜", ⅜", ½" | **#2 Binder:** U.T.S. 32,000 Lbs. Hook sizes: ⅜", ½", ½", ⅝"

Laughlin Clevis Grab Hooks are stocked by leading Industrial Supply, Wholesale Hardware, Oil Field, and other Distributors. Ask your distributor for information about the new loadbinder, or write for 4-page folder. It has complete description, specifications and users' comments.

For a complete listing of 1500 types and sizes of Laughlin wire rope and chain fittings, ask also for our Catalog 155.

THE THOMAS LAUGHLIN COMPANY

313 Fore Street, Portland, Maine

WILDCAT COMPLETIONS

Taubert, Harper & Lofton 1 Continental-Burns, Blk. 43, Freestone CSL. Dry. TD 6,600 ft.

Foard County: C. E. Hyde 1 Morgan, 19-8-H&TC. Dry. TD 5,303 ft.

Jack County: Akin & Dimock 1 Prideaux, E. Smith Sur., A-524. Dry. TD 3,755 ft.

Montague County: V. B. Likins 1 Crenshaw, S. Hernandez Sur., A-325. Dry. TD 5,550 ft.

Wilbarger County: Pounds-Rogers 1 Pounds-Rogers-Waggoner, 100-14-H&TC. Dry. TD 305 ft.

Wise County: Cristie, Mitchell & Mitchell 1 Crawford, J. M. Wesson Sur., A-877. IP 1,361,000 cu. ft. gas 16/64-in., TD 6,043 ft.

Young County: Megargal Drilling & Production Co. 1 Pringle, TE&L Sur. 216, A-463. Dry. TD 1,004 ft.

E. R. Perkins 1 Kunkel, TE&L Sur. 2447, A-1125. Dry. TD 1,267 ft.

WEST TEXAS

Crockett County: J. K. Kepley 1 Mitchell, 112-1-H&GN. Dry. TD 1,110 ft.

G. Stratton Jr. 1 Shannon, J. Wylie Ayers Sur. IP 89,000 cu. ft. gas, pay 2,214 ft., TD 2,232 ft.

The Texas Co. 1-A Shannon NCT-1, 11-10-GC&SF. IPP 62 BOPD, 27°, pay 1,800 ft. TD 1,840 ft.

Dawson County: Murphy Corp. & Associates 1 Walls, 12-35-T5N-T&P. IPP 168 BOPD, 38°, Wolfcamp 8,596-8,624 ft. TD 9,005 ft.

Seaboard Oil Co. 1 Middleton, 1-35-T6N-T&P. Dry. TD 4,373 ft.

Gaines County: The Texas Co. 2 Tobe Foster NCT-1, League 305, Dawson CSL, 7 mi. SE Seminole. IP 578 BOPD, ¼ in., 31°, Wolfcamp 9,242-52 ft. TD 13,010 ft.

Texas Crude Oil Co. 1-31 Jones, 31-AX-PSL. Dry. TD 4,581 ft.

Hockley County: Great Western Drilling Co. 1 Davis, 1-17-Wichita CSL, 6 mi. E Levelland. IP. 306 BOPD, ⅜-in., 46°, Strawn 10,070 ft. TD 10,089 ft.

Howard County: Heyser & Heard et al 1 Minnie Smith, 44-31-T3N-T&P. Dry. TD 7,900 ft.

Kent County: British American Oil Producing Co. 1-B Spires, 40-4-H&GN. Dry. TD 7,188 ft. Elev. 2,044 ft., Pennsylvanian 6,676 ft.

Motley County: Skelly Oil Co. 1 Windham, Blk. 0/1, Sur. 7, SF 2324, A-1661, 5 mi. NW Dumont. Dry. TD 7,281 ft. Elev. 2,243 ft., Pennsylvanian 5,072 ft., Mississippian 6,660 ft., pre-Cambrian 7,240 ft.

Pecos County: Houston Oil Co. 1 Eaton, 23-3-H&TC. Dry. TD 7,476 ft. Elev. 2,434 ft., Ellenburger 6,874 ft.

Superior Oil Co. 1-52 Wangerin, 52-11-H&GN, 5 mi. S Girvin. IP 75 BOPD, open 2-in., 32°, pay 2,910 ft. TD 4,477 ft.

Reeves County: J. D. Arthur and Chas. A. Grissom 1 Ramsey, 26-70-PSL. Dry. TD 3,974 ft. Delaware sand 3,735 ft.

Runnels County: George W. Strake 1 Bryan, J. Earle Sur. 449. Dry. TD 5,282 ft. Elev. 2,045 ft., Caddo 5,190 ft.

West Central Drilling Co. 1-A Lehman, 333-64-H&TC. Dry. TD 4,225 ft.

Schleicher County: British-American Oil Producing Co. 1 Keyes, 69-Y-GH&SA. Dry. TD 6,205 ft. Elev. 2,419 ft., Srawn 5,436 ft., Ellenburger 5,994 ft.

Lone Star Producing Co. 1 Willoughby, 147-A-HE&WT. Dry. TD 1,512 ft.

Winkler County: Ralph Lowe 1-C Morton, 18-B12-PSL. Dry. TD 3,540 ft.

WILDCAT COMPLETIONS

SOUTHEAST NEW MEXICO

Eddy County: Yates et al 1 McKee-Yates State, 36-19s-29e. Dry. TD 1,666 ft.

Lea County: Argo Oil Corp. 1 Tomlinson, 14-15s-28e. Dry. TD 12,890 ft. Elev. 3,740 ft., Devonian 12,822 ft.

Roosevelt County: Amerada Petroleum Corp. 1-C Federal, 10-7s-32e. IPP 186 BOPD, 45°, Devonian 9,229 ft. TD 9,637 ft.

ILLINOIS

Coles County: The Texas Co. 1 Miller, SW NE NE 1-11n-7e. Dry. TD 2,203 ft.

Cumberland County: F. & W. Oil Co. 1 Foss, NW SW NW 25-11n-10e. Dry. TD 812 ft.

Hancock County: C. M. Faulkner 9 Aleshire, SE SW SE 24-4n-5w. Dry. TD 451 ft.

Saline County: Slagter Producing Co. 1 Hale, NE SW NE 22-8s-6e. Dry. TD 3,075 ft.

Wayne County: Misener Drilling Co. 1 Johnson, S½ SE SE 12-1s-8e. Dry. TD 3,185 ft.

White County: Ashland Oil & Refining Co. 1 Black-Stokes, SW NW NE 28-4s-10e. Dry. TD 3,060 ft.

INDIANA

Dubois County: H. C. Stone 1 Hoffman, NW NW SE 30-1n-4w. Dry. TD 646 ft.

Grant Mullinax 1 Bockelman, SE NW SE 23-1s-5w. Dry. TD 740 ft.

C. A. Ray 1 Lottes, SE NW NW 24-1s-5w. IPP 25 BOPD, Cypress sand 504-506 ft. TD 509 ft. (Extends Jasper North pool.)

Sullivan County: R. G. Lowry 1 Hayes-Truman-Perry Creek Cem., NE NW NW 25-8n-11w. Dry. TD 1,797 ft.

H. A. Johnson 1 Riggs, SE SE SW 36-8n-11w. IPP 5 BOPD, Pa. sand 780-788 ft. TD 788 ft. (Opens Graysville South pool.)

Warrick County: Mulzer Bros. 1 Neikam, SE NE NW 24-4s-6w. Dry. TD 1,184 ft.

WESTERN KENTUCKY

Henderson County: George Hoffman et al 2 Haynes, C E½ SW NW NE 8-P-26. Dry. TD 2,223 ft.

MICHIGAN

Allegan County: Cook Drilling Co. 1 State-Clyde, NW SE NW 23-2n-15w. Dry. TD 1,304 ft. in Traverse lime.

Arenac County: W. B. Stewart 2 Merkli et al, NW NW SW 29-20n-3e. Dry. TD 3,087 ft. in Dundee.

Oceana County: Lowell Bernhardt 1 Bowers, NE SE NE 10-14n-16w. Dry. TD 2,177 ft. in Traverse Lime.

WEST VIRGINIA

Randolph County, Middle Fork district: Washington Natural Gas Co. 1 J. E. Hanifan et al, 225,000 cu. ft., Fifth sand 2,251-2,303 ft., gas 2,252 ft. TD 2,620 ft.

ALABAMA

Monroe County: Sunnyland Contracting Co. 1 Gantt, C NE NW 29-4n-4e. Dry. TD 6,104 ft. Elev. 102 ft., Lower Cretaceous 5,888 ft.

MISSISSIPPI

Calhoun County: Carter Oil Co. 1 Crane, SW NE SW 31-13s-1e. Dry. TD 9,231 ft.

Pearl River County: Marshall Young 1 Phoenix, C SE SW 8-1s-16w. Dry. TD 9,348 ft.

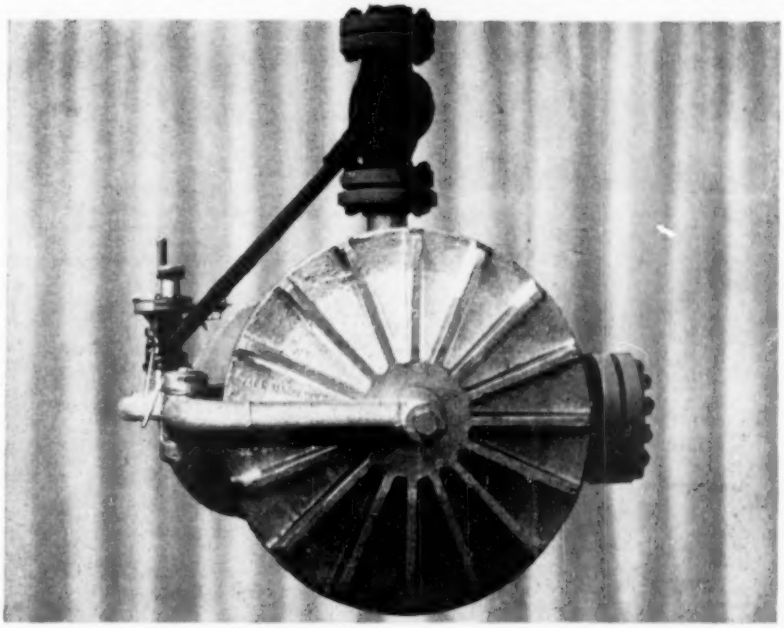
SOUTH LOUISIANA

Cameron Parish: Max Pray and R. W.

AS THE FASHION EDITOR WOULD SAY:

"Here's the Cap

THE PIPELINES ARE WEARING"



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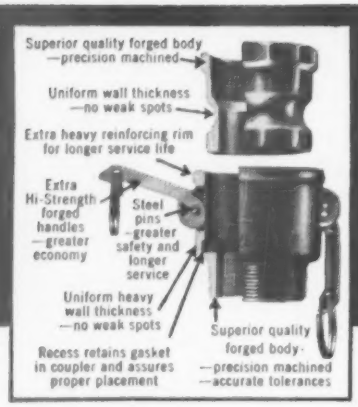
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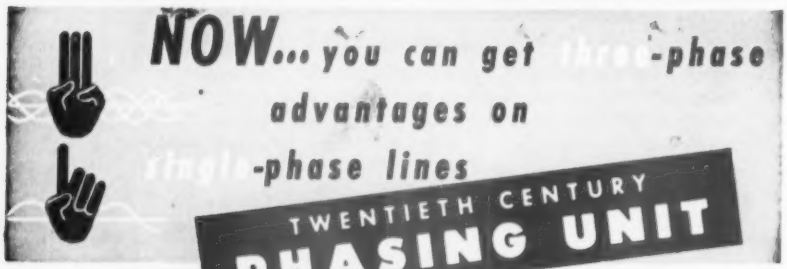
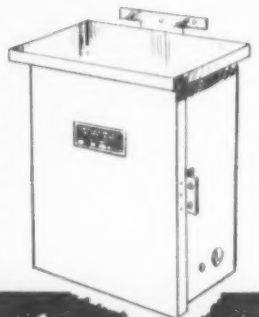


for oilfields and industrial installations...



The Twentieth Century Phasing Unit improves power factor and utilizes all the protective devices of a standard motor controller. It is easy to install and easy to maintain . . . costs less as compared to single phase motors. There is no need to stock both three phase and single phase motors as spares. Now you need handle only three-phase motors. The Twentieth Century Phasing Unit incorporates many protective all-weather devices thus permitting operation at all times.

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ELECTRIC SUPPLY CO.
526 North Main • TULSA

WILDCAT COMPLETIONS

O'Meara 1 Fawver, 4-15s-5w. IP 2,000 M.c.f. daily and 45 BCPD, 8/64-in., perforations 11,458-72 ft. TD 12,726 ft. (New field.)

Jefferson Davis Parish: Richardson & Bass 1 Texas-Sears et al, 14-9s-6w. IP 2,050 M.c.f. daily and 58 BCPD, 8/64-in., perforations 11,328-44 ft. TD 14,670 ft. (New field).

Lafourche Parish: Stanolind Oil & Gas Co. and K & H Operating Co. 1 Gheens, 52-15s-19e. IP 1,413 M.c.f. daily and 38 BCPD, 8/64-in., 54°, perforations 12,900-10 ft. TD 14,585 ft. (Extends Raceland field).

California Co. and Superior Oil Co. 2 Clovelly, 45-18s-21e. IP 120 BOPD, 9/64-in., 31.7°, perforations 11,222-48 ft. TD 12,097 ft. (New pay in Cutoff field).

Pointe Coupee Parish: Hudson Gas & Oil Corp. 1 Jumonville et al, 41-12s-7e. Dry. TD 10,093 ft.

Terrebonne Parish: Arkansas Fuel Oil Co. and John W. Mecom 2 Southdown Unit 1, 72-17s-16e. IP 7,050 M.c.f. daily with spray of condensate, 16/64-in., 52°, perforations 11,316-26 ft. TD 12,161 ft. (New field, or extends Hollywood field).

Kerr-McGee Oil Industries, Inc., I-C State Lease 750, Block 28, Ship Shoal area (offshore). IP 6,640 M.c.f. daily and 80 BCPD, 20/64-in., perforations 8,604-28 ft. TD 14,800 ft. (New pay in Ship Shoal Block 28 field.)

NORTH LOUISIANA

Caddo Parish: David Crow, Executor 1 fee, 11-18n-14w. IP 75 M.c.f. of gas per day, 940-58 ft. TD 958 ft. (Gas well).

Concordia Parish: Carter Oil Co. 1 Graham, C SW SW 45-5n-9e. IPF 60 BOPD, 5/64-in., 46.7°, Wilcox 6,023-29 ft. TD 6,710 ft. (Discovery ¾ mile northwest Deer Park field).

Sunnyland Contracting Co., Inc., 1 MaGee-Evans Land Co., 17-6n-9e. Dry. TD 6,803 ft.

Richland Parish: Atlantic Refining Co. 1 Ferguson, strat test, 7-17n-8e. Dry. TD 3,150 ft.

Atlantic 1 Dr. Harrison Jordan, strat test, 35-18n-7e. Dry. TD 2,901 ft.

Union Parish: Zach Brooks Drilling Co. and George M. Harris 1 C. J. Baxter Est., 32-23n-3w. Dry. TD 9,514 ft.

ARKANSAS

Lafayette County: C. G. Davis Drilling Co. 1 Strange, C W½ NW NW 14-16s-23w. IPP 90 BOPD, 19°, Tokio 2,492-95 ft. TD 2,585 ft. (Discovery well, East Stamps field).

OKLAHOMA

Beaver County: United Carbon 1 Kiser, C NE NE 22-6n-22eCM. IP 2,300 M.c.f. of gas per day, Morrow sand 6,280-94 ft. TD 6,480 ft. (Gas discovery).

Cimarron County: United Producing Co. 1 Spradlin, C SW NE 3-4n-9eCM. IP 22,000 M.c.f. of gas per day, Keyes sand 4,512-30 ft. TD 4,612 ft. (Gas discovery).

Cotton County: H. W. Chamberlain 1 Collins, NW SE NE 5-3s-9w. Dry. TD 2,506 ft.

Creek County: Lotus Oil Co. and D&L Oil Co. 1-A Woods, NW NE SE 18-15n-7e. IPP 25 BOPD, second Wilcox sand 4,100-4,111 ft., 39°. TD 4,111 ft. (Oil discovery).

Garvin County: John H. Bracker 1 Burns, SE SE NW 36-4n-3e. IPF 40-48 BOPD,

1,707-13 ft., 29.5°, 20 64-in. TD 1,762 ft. (Oil discovery).

Kay County: H. Waggoner Drilling Co. 1 Lewis, NE NE NE 27-27n-3e. IPF 30 BOPD, Layton 2,378-92 ft., 6/64-in. TD 3,463 ft. (Oil discovery).

Kiowa County: J. H. Riley 1 Poole, NE SE NE 29-7n-16w. Dry. TD 600 ft.

Lincoln County: W. F. Snakard 1 Edison, NW NE NE 1-13n-2e. Dry. TD 4,780 ft.

Mid-Continent Petroleum Corp. 1 School Land, NW NE NW 36-14n-5e. Dry. TD 3,652 ft.

W. H. Elson et al 1 Trimble, NE NE SE 27-16n-5e. Dry. TD 4,385 ft.

McClain County: Gulf Oil Corp. 1 Jacobs, C SW NW 8-5n-4w. Dry. TD 13,476 ft.

Okfuskee County: Appleton Oil Co. 1 McMahan, NE NW NE 17-11n-10e. Dry. TD 1,651 ft.

Pontotoc County: Skaggs Oil Co. 1 Perry, NE SE NE 11-3n-6e. Dry. TD 1,691 ft.

Seminole County: Austin Drilling Co. 1 Collins, NW NE SE 1-5n-5e. Dry. TD 2,300 ft.

KANSAS

Barton County: V. E. Autry et al 1 Dodge, SE SE SE 6-20s-12w. IPP 10 BOPD, Arbuckle 3,420-36 ft. TD 3,436 ft. (Opens Sunny Valley Northeast pool).

Cowley County: Aladdin Petroleum Co. 10 Drennen, SW SE NE 32-34s-3e. IPP 258 BOPD, Arbuckle 3,781-91 ft. TD 3,791 ft. (New pay at Gibson pool).

Ellis County: National Cooperative Refining Co. 1 Dinkel, NE NW SE 32-13s-16w. Dry. TD 3,505 ft.

Graham County: Imperial Petroleum Co. 1 Stewart, SW SE NW 16-10s-23w. Dry. TD 4,240 ft.

The Texas Co. 1 Brungardt, SW NW NE 30-14s-16w. TD 3,473 ft.

Harper County: Frank Purcell 1 Culver, NW NW SE 9-31s-8w. IPP 33 BOPD, Mississippian 4,406-11 ft. TD 4,411 ft. (Opens Grabs East pool).

Morris County: Gruenerwald 1 Williams, NW NE NW 26-15s-9e. IPP 426 BOPD, Viola lime 3,089-96 ft. TD 3,096 ft. (Oil discovery).

Norton County: Harry Gore 4 Lawson, NE NE SE 25-3s-24w. IPP 150 BOPD, Reagan sand 3,682-88 ft. TD 3,705 ft. (New pay in Norton pool).

Peel-Hardman 1 Long, NE NE NE 28-5s-22w. Dry. TD 3,770 ft.

Pawnee County: Tom Allan and Buffalo Oil Corp. 1 Harp, SW SW SE 28-21s-17w. Dry. TD 3,970 ft.

Reno County: Gramhart & Miller 1 Teter, SW SE NE 11-23s-5w. Dry. TD 3,959 ft.

Rooks County: Petroleum, Inc., 1 Stamper "E," SW NW NE 20-8s-17w. Dry. TD 3,505 ft.

Russell County: H. T. Manning 1 Stricker, NE NW SW 16-15s-14w. Dry. TD 3,325 ft.

Sheridan County: Cities Service Oil Co. 1 James, NE NE NW 7-8s-28w. Dry. TD 4,688 ft.

Seward County: Cities Service 1 Holt "B," C NW NE 28-32s-34w, deep Hugoton field test. IP 27,800 M.c.f. of gas per day from Topeka lime 4,184-4,200 ft. TD 6,384 ft. (New pay discovery in Hugoton gas field area).

NORTH DAKOTA

Mounfrail County: William Herbert Hunt 1 W. & D. Dunham, C NW NW 24-155n-90w. Dry. TD 11,109 ft. in Silurian.

Pierce County: Calvert Exploration Co. 1 Ramburg, NE SE 17-154n-72w. Dry. TD 4,440 ft. in Sulurian.

WILDCAT COMPLETIONS

CALIFORNIA

Kern County: Bell & Burden 1 B & B, 11-28s-19e. Dry. TD 2,842 ft.

Drumm Bros. Petroleum Corp. 1 Doc Crandall, NE NE 17-30s-29e, IPF 489 BOPD, 16/64-in. choke, 22.6° gravity, perfs. 5,001-5,209 ft. in Nozu sand (middle Miocene), TD 5,955 ft. (New fault block pool in West Edison area.)

Golden Bear Oil Co. 87-33 K.C.L., 33-29s-27e. Dry. TD 4,675 ft.

Tulare County: Urich-Lowell Oil Co. 1 Logsdon, 11-18s-23e. Dry. TD 4,090 ft.

Ventura County: The Texas Co. B-1 Elkins, 9-3n-19w. Dry. TD 7,004 ft.

Yolo County: Humble Oil & Refining Co. 1 Darsie-Hutchinson, 28-6n-3e. Dry. TD 8,563 ft.

MONTANA

Petroleum County: Ike Taylor 1 McGlenn, C E½ SE NE 3-13n-26e. Dry. TD 3,401 ft. in Kibbey.

Roosevelt County, West Poplar: Carter Oil Co.-Phillips Petroleum Co. 1 Mason, C NE NE 20-29n-50e. Dry. TD 8,649 ft. in Silurian.

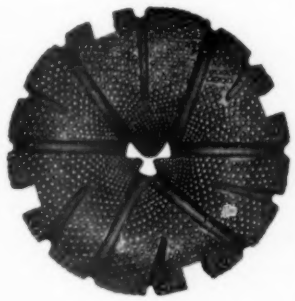
WYOMING

Carbon County, South Big Medicine Bow: McElroy Ranch, Natural Gas & Oil Co. and Bruce Anderson 1 Horne, SW NW NE 11-20n-79w. Dry. TD 6,507 ft. in third Sundance. Suspended.

Converse County, North Brenning: Ryan Oil Co. 1 Green Valley Sheep Co., C NW SE 31-33n-173w. Dry. TD 2,400 ft. in Chugwater.

Johnson County: Atlantic Refining Co. 2

the answer to many of your drilling problems



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THE OIL AND GAS JOURNAL

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WILDCAT COMPLETIONS

Government, C NW SE 26-43n-81w. Dry. TD 3,000 ft. in first Wall Creek.

Niobrara County: H. & H. Drilling Co. et al 1 Government, C NW NW 14-40n-66w. IPF 300 BOPD, Newcastle sand discovery, new field. TD 7,720 ft. in Newcastle sand.

UTAH

Emery County, Bull Canyon: Equity Oil Co. 1 Bull Canyon, C SW NW 2-18s-10e. Dry. TD 5,133 ft.

Garfield County, Circle Ridge: N. B. Hunt 1 Circle Cliffs, C NE SW 24-34s-7e. Dry. TD 5,628 ft. in Bowman.

San Juan County, Cross Canyon: L. W. Glasco and Shell Oil Co. 1 Government, NE SE NW 35-38s-25e. Dry. TD 8,054 ft. in salt.

Uintah County, Brennan Bottom: Gulf Oil Corp. 1 Brennan Bottom, C NE SE 13-7s-20e. IPP 162 BOPD, Green River discovery, new field. TD 8,000 ft. in Green River.

COLORADO

Logan County: Fox-Witherspoon Drilling Co. 1 Budin, C NE SW 35-9n-55w. Dry. TD 5,580 ft.

S. D. Johnson 1 Minnie Riley, SW SE NE 13-7n-53w. Dry. TD 4,662 ft.

S. D. Johnson 1 Lubchenco, S½ SE NE 28-7n-53w. Dry. TD 4,778 ft.

O'Donnell & Edmondson 1 Warnacke, NW NW SE 31-9n-54w. Dry. TD 5,420 ft.

Moffat County, Gossard dome: Carter Oil Co. 1 Gossard, Inc., SE NE SE 29-5n-93w. Dry. TD 4,859 ft.

Morgan County: S. D. Johnson, Byrne, Doing & Gilliam Drilling Co. 1 Glenn, NW NW NE 33-2n-57w. Dry. TD 5,526 ft.

Kimbark Co. 1 Queen, C SW NW 26-1n-56w. IPP 133 BOPD, "D" sand discovery, new field in Sand River area. TD 5,352 ft.

Weld County, South Greasewood: S. D. Johnson and Cortlandt S. Dietler 1 Spinner, C NE NE 35-6n-61w. IPF 1,200 BOPD, ½-in., "D" sand discovery, new field. TD 6,754 ft.

Ohio Oil Co. and C. C. Thomas 1 Nordloh, SE SE SE 20-5n-63w. Dry. TD 8,328 ft.

MANITOBA

California Standard 2-29 Pierson, LSD 2, 29-2-29w1. Dry. TD 4,372 ft.

SASKATCHEWAN

Socony - Woodley - Southern 30-3 Bellegarde, LSD 3, 30-6-31w1. Mission Canyon oil well. TD 3,487 ft.

Wilrich-Trans Era 9 Maidstone, SW¼ LSD 15, 32-48-22w3. Dry. TD 1,653 ft.

Socony-Sohio 11-7 Richlea, LSD 7, 11-26-19w3. Dry. TD 2,386 ft.

Alminex 4-15 Crystal, LSD 4, 15-30-27w3. Viking oil well. TD 2,500 ft.

Sturgeon & Associates 3 Smiley, LSD 11, 31-30-26w3. Dry. TD 2,983 ft.

Socony-Woodley-Southern 3-7 Success, LSD 7, 3-17-16w3. Dry. TD 7,426 ft.

ALBERTA

Socony-Canadian Superior 1 North Beiseker, LSD 8, 11-29-26w4. Dry. TD 7,552 ft.

Baysel - Great Plains-Seaboard 14-21 West Buck Lake, LSD 14, 21-46-7w5. Cardium oil well. TD 5,361 ft.

Shell Oil Co. A-4-29 Cadogan, LSD 4, 29-38-3w4. Dry. TD 2,835 ft.

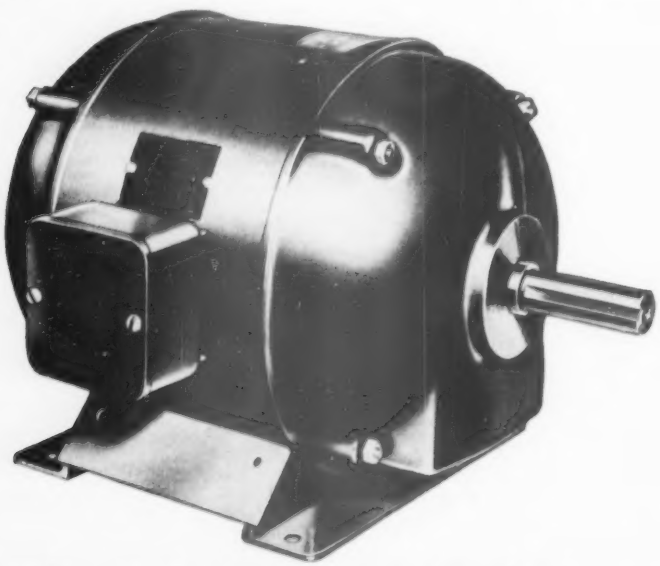
Shell 1 Eureka River, LSD 9, 24-88-6w6. Dry. TD 8,708 ft.

Stanolind-Hudson's Bay "C" 1 Pembina Crown, LSD 2, 6-50-9w5. Cardium oil well. TD 6,365 ft.

Cities Service 1 Alcan, LSD 14, 24-73-10w6. Dry. TD 4,538 ft.

Sun 6-11 Russet Creek, LSD 6, 11-121-23w5. Dry. TD 4,780 ft.

Alberta Giant Roberts 1 Thorsby, LSD 16, 33-49-1w5. Dry. TD 6,898 ft.



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International Harvester Opens Lubbock Office

International Harvester Co. has opened a new motor-truck district sales office in Lubbock, Tex., according to Daune F. Kuntz, the company's southwest regional motor-truck sales manager. The office is located in a suite of rooms in the Stanolind Building.

Kuntz said that the new sales facility would serve the approximately 125 International motor - truck dealers and four company-owned International motor-truck sales branches located in West Texas, eastern New Mexico, and the southwestern portion of Oklahoma.

The opening of Harvester's district sales office will mark the second company operation to be established in Lubbock. An International motor-truck retail sales branch was opened there in 1952.

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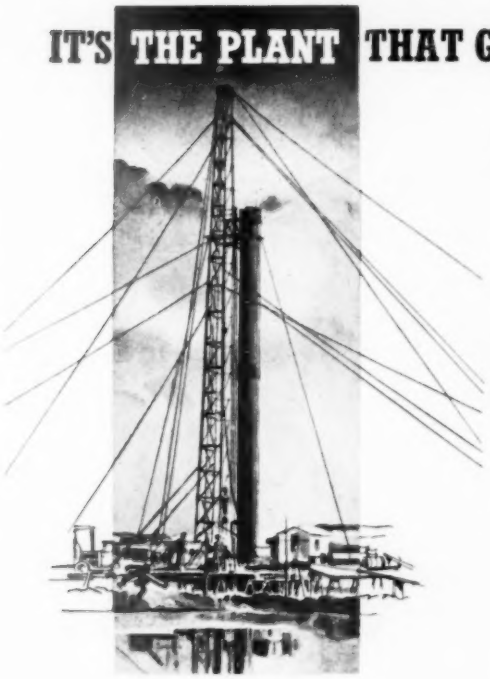

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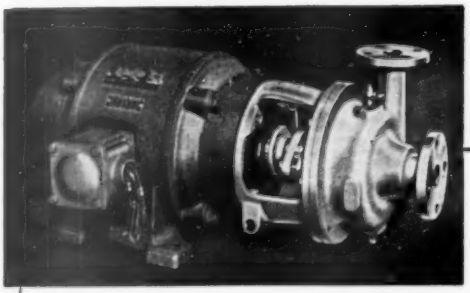

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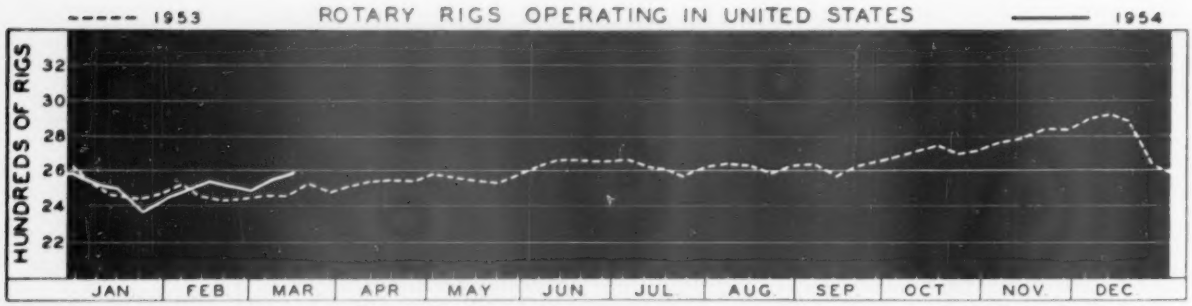
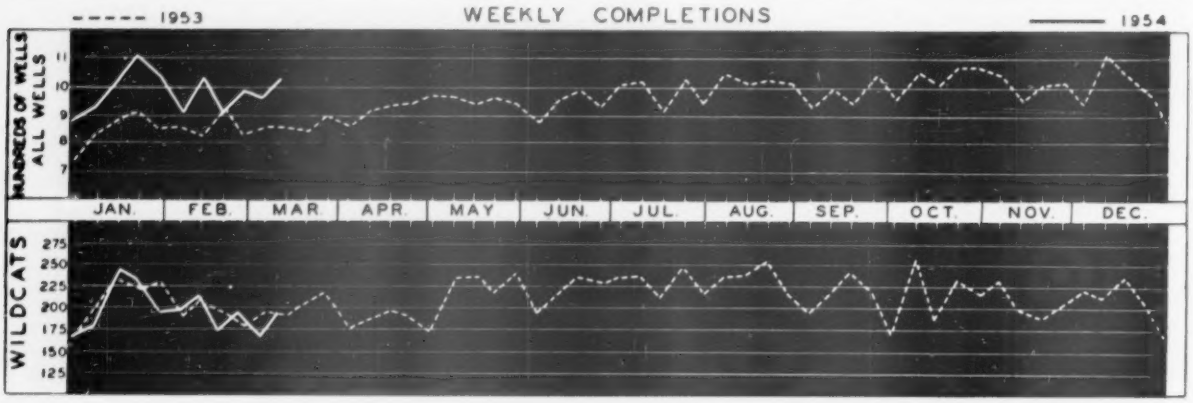




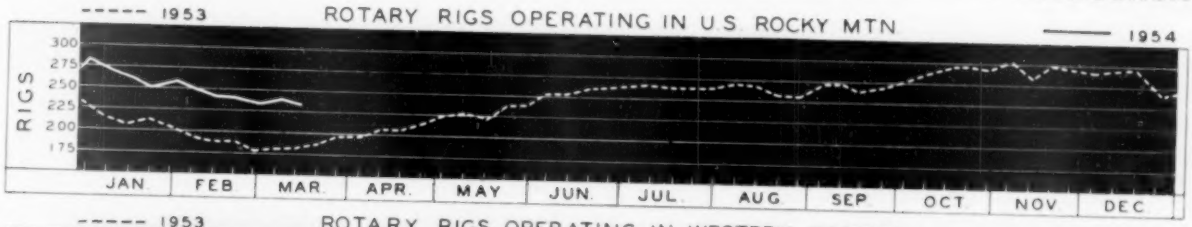
CURRENT STATISTICS

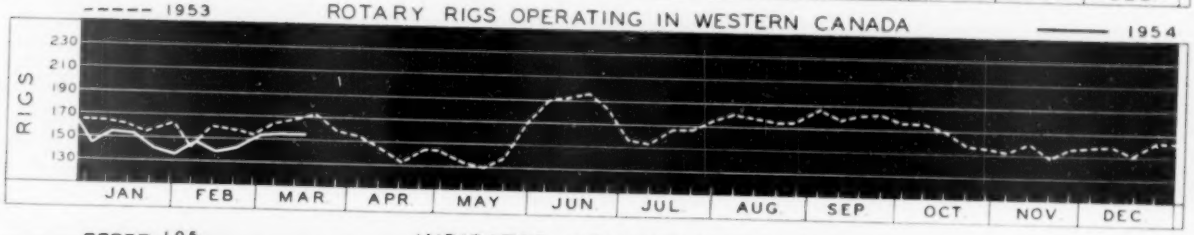
EXPLORATION

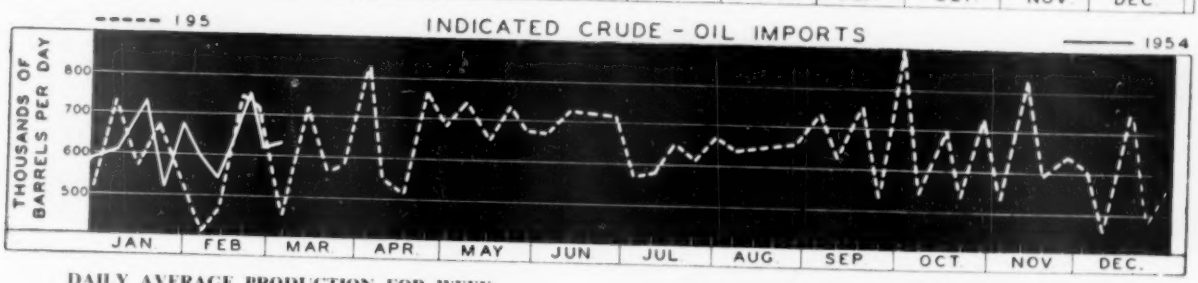
WEEKLY WELL COMPLETIONS . . . WEEK ENDED MARCH 13, 1954

	Total of all wells					Mar. 13		Wildcat completions and discoveries					Cumulative total, 1954				
	Comp.	Oil	Gas	Dry	Footage	1954	1953	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
Pennsylvania-New York	40	18	3	*19	56,502	472	434	0	0	0	0	0	0	0	1	8	9
West Virginia	7	0	5	2	14,718	104	97	0	0	1	0	1	0	0	5	3	8
Ohio	37	14	10	†13	74,440	211	196	0	0	0	0	0	0	0	2	1	3
Indiana	12	5	0	7	14,161	143	235	2	0	0	4	6	2	0	0	32	34
Kentucky	25	11	8	6	50,825	221	189	0	0	0	1	1	4	0	0	25	29
Illinois	43	24	0	19	106,217	506	368	0	0	0	6	6	0	0	0	83	83
Michigan	8	4	0	4	27,838	124	114	0	0	0	3	3	0	0	0	56	56
Kansas	95	47	12	†36	329,984	861	935	5	0	1	9	15	14	0	3	106	123
Nebraska	5	0	1	4	28,518	74	58	0	0	0	0	0	5	0	0	18	23
Oklahoma	191	124	8	‡59	558,787	1,896	1,390	3	0	2	9	14	23	2	7	123	155
Texas	369	210	19	140	1,704,853	3,525	3,258	11	1	2	84	98	149	19	34	819	1,021
North Central (Dist. 7-B & 9)	152	77	1	74	494,896	1,272	1,171	4	0	1	40	45	75	2	3	318	398
West (Dist. 7-C & 8)	83	62	1	20	478,630	828	738	6	0	1	12	19	43	0	5	151	199
Panhandle (Dist. 10)	19	13	3	3	64,912	176	156	0	0	0	2	2	0	0	2	15	17
Eastern (Dist. 5 & 6)	15	6	4	5	109,932	148	157	1	0	0	3	4	5	0	3	39	47
Gulf Coast (Dist. 2 & 3)	57	29	8	20	355,598	572	490	0	1	0	15	16	14	8	10	145	177
Southwest (Dist. 1 & 4)	43	23	2	18	200,885	529	546	0	0	0	12	12	12	9	11	151	183
Louisiana	58	43	0	15	383,615	669	531	6	1	0	6	13	23	11	6	57	97
Northern	34	25	0	9	105,281	357	247	1	0	0	5	6	4	0	0	18	22
Southern	24	18	0	6	278,334	312	284	5	1	0	1	7	19	11	6	39	75
Arkansas	11	9	0	2	41,848	153	94	1	0	0	0	1	6	0	0	20	26
Mississippi	6	2	0	4	47,089	73	74	0	0	0	2	2	2	0	0	26	28
Southeastern States	1	0	0	1	6,104	25	28	0	0	0	1	1	1	0	1	19	21
Montana	4	2	0	2	18,801	58	87	0	0	0	2	2	1	0	0	19	20
Wyoming	27	20	1	6	138,654	312	119	1	0	0	3	4	11	0	2	39	52
Colorado	24	15	1	8	135,590	220	104	2	0	0	7	9	9	0	0	83	92
Utah	5	1	1	3	30,864	15	17	1	0	0	3	4	1	0	0	7	8
New Mexico	16	8	4	4	73,044	264	274	1	0	0	2	3	5	0	1	35	41
California	37	30	0	7	161,847	481	517	1	0	0	5	6	16	0	4	100	120
North Dakota	8	6	0	2	66,171	43	50	0	0	0	2	2	1	0	0	12	13
Miscellaneous	0	0	0	0	0	50	13	0	0	0	0	0	0	0	0	7	7
Total United States	1,029	593	73	363	4,070,470	10,500	9,182	34	2	6	149	191	273	32	66	1,698	2,069
Total previous week	965	529	60	376	3,825,051			18	5	6	138	167	239	30	60	1,549	1,878
Total March 14, 1953	862	432	87	343	3,515,141			25	0	10	156	191	282	20	71	1,737	2,110

Service wells included: *17, †1, ‡7.



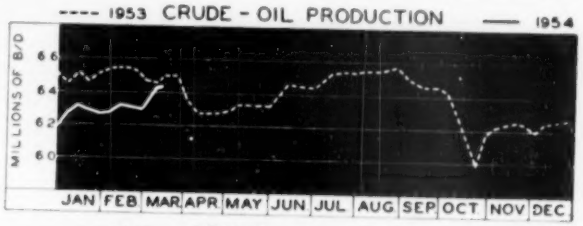


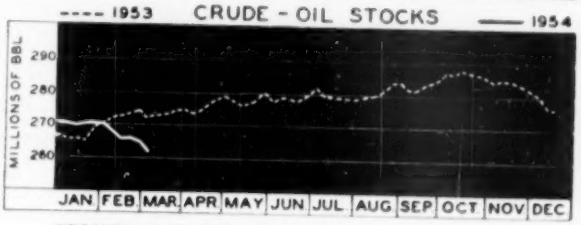


DAILY AVERAGE PRODUCTION FOR WEEK

	March 13			Mar. 6
	Crude oil	Lease condensate	Total	total
Alabama	4,300		4,300	4,400
Arkansas	74,900	600	75,500	76,200
California	997,500		997,500	1,001,000
Colorado	115,600		115,600	113,300
Eastern	58,000		58,000	58,000
Florida	1,475		1,475	1,475
Illinois	175,000		175,000	179,900
Indiana	30,600		30,600	31,400
Kansas	322,500		322,500	320,800
Kentucky	34,400		34,400	34,300
Louisiana	643,400	48,700	692,100	690,050
North	108,400	3,700	112,100	112,200
South	535,000	45,000	580,000	577,850
Michigan	33,300		33,300	33,100
Mississippi	88,300	3,850	92,150	93,000
Montana	30,700		30,700	35,100
Nebraska	18,900		18,900	19,000
New Mexico	205,800	1,675	207,475	207,350
Oklahoma	517,400		517,400	519,800
Texas	2,730,000	53,000	2,783,000	2,766,200
Dist. 1	43,500	575	44,075	43,550
Dist. 2	144,300	7,900	152,200	150,850
Dist. 3	424,700	25,000	449,700	448,175
Dist. 4	253,700	6,200	259,900	257,875
Dist. 5	47,600	450	48,050	46,700
Dist. 6	117,300	5,800	123,100	121,850
East Texas field	242,000		242,000	239,850
Dist. 7-B	135,400	75	135,475	134,000
Dist. 7-C	175,700	4,750	180,450	180,350
Dist. 8	868,700	1,600	870,300	866,900
Dist. 9	192,000	600	192,600	191,600
Dist. 10	85,100	50	85,150	84,500
Utah	4,300		4,300	4,500
Wyoming	231,200		231,200	234,100
North Dakota	14,400		14,400	14,900
Total U. S.	6,331,975	107,825	6,439,800	6,437,875
Change from previous week, up			1,925	
Canada	229,700		229,700	286,350
Total U. S. production January 1-March 13			455,588,200 bbl.	
Same period last year (crude plus cond.)			*471,796,475 bbl.	

*Includes 6,691,575 bbl. condensate.



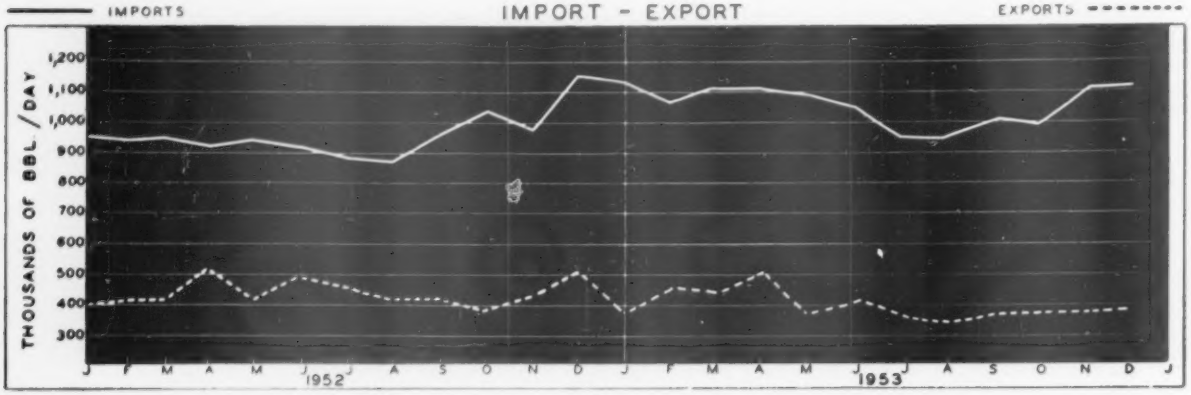


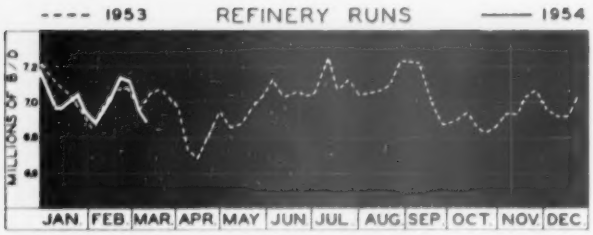
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

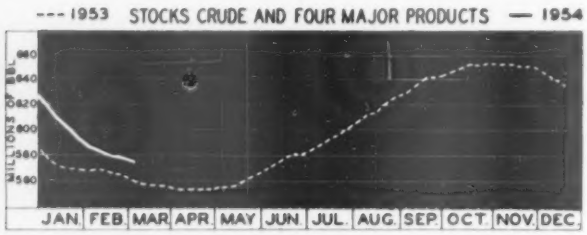
(Thousands of barrels)

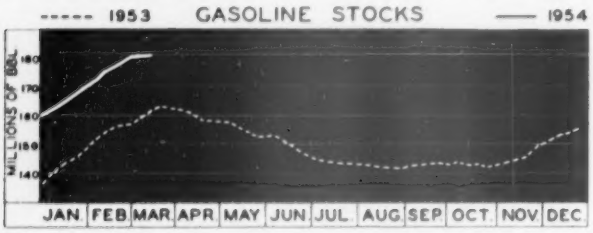
	Mar. 6, '54	Feb. 27, '54	Mar. 7, '53
Pennsylvania Grade	2,709	2,704	2,278
Other Appalachian	1,648	1,742	1,995
Illinois, Indiana, Michigan	11,695	12,004	10,526
Arkansas	3,124	2,972	2,824
Louisiana	14,427	14,323	16,147
North	2,646	2,612	3,097
Gulf	11,781	11,711	13,050
Mississippi	3,329	3,307	3,748
New Mexico	7,539	8,013	7,553
Oklahoma and Kansas	35,689	36,408	36,008
Texas	119,626	121,049	135,512
East Texas	10,782	11,015	11,307
West Texas	50,844	51,835	65,113
Texas Gulf	25,049	24,514	25,805
Other Texas	32,951	33,685	33,287
Rocky Mountain	16,590	16,574	15,656
California	34,061	33,871	32,921
Foreign	†11,497	11,294	7,280
Total	261,934	264,261	272,448

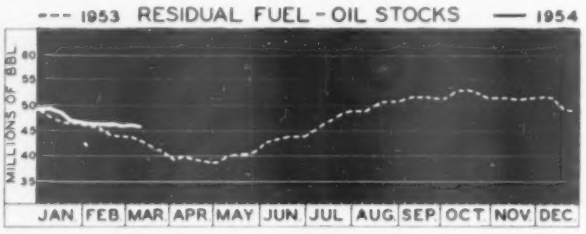
*Bureau of Mines. †Includes 2,773,000 bbl. in California.









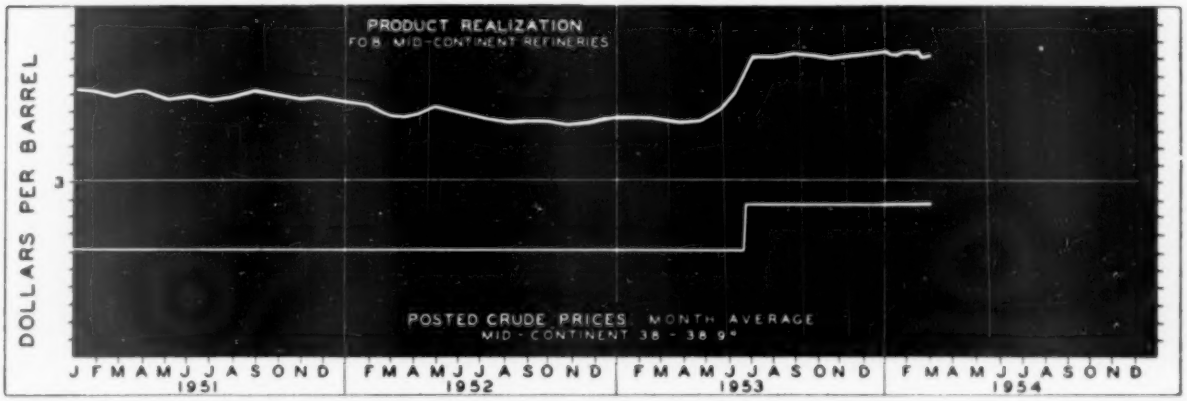


A.P.I. REFINERY REPORT, MARCH 13

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, March 1953 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	997	416.1	42.4	236.7	204.7	35,658	8,292	23,514	10,214	1,044	398.9	36.4	258.5	233.0
Appalachian:														
District 1	108	39.6	7.7	22.3	8.8	4,569	449	1,049	597	108	43.4	6.6	20.1	15.3
District 2	94	44.1	6.9	17.0	14.6	2,153	385	486	248	96	47.2	7.0	15.4	16.0
Ind., Ill., Ky.	1,272	675.9	69.8	245.1	175.3	40,003	4,059	10,488	4,447	1,241	657.0	71.1	218.0	164.3
Okla., Kans., Mo.	592	349.4	20.0	150.6	45.0	19,756	1,096	6,598	1,164	576	334.7	13.0	132.7	58.0
Inland Texas	235	173.7	9.6	43.8	28.3	7,331	262	1,013	1,258	254	164.2	12.3	44.3	33.4
Texas Gulf Coast	1,691	762.4	164.3	383.3	226.3	23,871	2,186	6,057	4,602	1,779	798.2	145.4	428.1	248.1
La. Gulf Coast	555	247.9	49.7	126.7	65.8	10,376	1,233	2,628	1,176	534	269.4	51.3	141.4	49.4
N. La. and Ark.	92	34.6	8.9	22.8	7.0	4,138	520	861	92	79	31.5	7.5	17.6	6.8
Rocky Mountain:														
New Mexico	18	12.3		2.9	2.9	200		41	33	18	10.7	0.5	2.7	4.2
Other Rocky Mtn.	243	113.0	5.0	48.3	41.3	8,125	174	1,886	736	230	106.3	2.4	50.6	42.3
California	986	461.4	10.6	145.6	374.6	23,403	364	10,953	21,406	1,043	457.6	5.7	159.5	385.1
Mar. 13, 1954	6,883	3,330.4	394.9	1,445.1	1,194.6	179,583	19,020	65,574	45,973	7,002	3,319.1	359.2	1,488.9	1,255.9
Mar. 6, 1954	6,951	3,410.6	426.0	1,516.7	1,170.7	179,203	19,905	68,194	46,065					
Mar. 14, 1953	7,060	3,306.7	346.4	1,506.3	1,331.1	160,869	18,640	62,545	42,284					

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipe lines.


PRODUCT REALIZATION
F.O.B. MID-CONTINENT REFINERIES
DOLLARS PER BARREL
3
POSTED CRUDE PRICES: MONTH AVERAGE
MID-CONTINENT 38 - 38.9°
J F M A M J J A S O N D
1951
F M A M J J A S O N D
1952
F M A M J J A S O N D
1953
F M A M J J A S O N D
1954

In this trend chart refinery realization is based on average Mid-Continent grade crude oil (not 38° gravity only) and average prices for refinery products as published in The Oil and Gas Journal basis Oklahoma (Group 3). Refinery yields confined to gasoline, kerosine, distillate and fuel oil. Realization averaged $3.71 for week ended March 6, $3.70 for previous week, and $3.34 for March 1953. The above trend information is based on volumes and current prices and therefore does not reflect changes in operating costs.

REPRESENTATIVE QUOTATIONS

Representative spot-market quotations of leading suppliers as of March 17, 1954. Figures are f.o.b. plant for tank-car shipments in cents per gallon, except for residual fuel oil which shows the price per barrel and wax, in cents per pound.

GASOLINE, KEROSINE, AND FUEL OILS

	Mid-Continent Group 3	New York Harbor (barge)	Texas Gulf Coast
Regular gasoline	10.75-11	11.5-12.25	9.5-10
Premium gasoline	11.75-12	13.25-14	11.5-12.25
42-44 w.w. kerosine	9.125-9.375	10.4-10.65	9.5-9.75
No. 2 straw fuel oil	8.25-8.375	9.4-9.65	8.5-8.75
No. 6 residual	$1.20-1.30	$2.20-2.40	$1.85-1.95

NATURAL GASOLINE

	Group 3	North Texas	N. La.
Grade 26-70	5.0	4.5	4.75
Grade 18-55	6.0	5.5	5.75

LUBRICATING OILS
South Texas

200 vis., No. 2-3 neutral	12.5
750 vis., No. 3-4 neutral	15.5
2,000 vis., 5-6 neutral	17

LUBRICATING OILS
Mid-Continent

150-160 vis., D bright stock, 0-10 pp	19
200 vis., No. 3 neutral, 0-10 pp.	14.25

Western Pennsylvania

145-155 vis., 10 p.t. bright stock	18.5
180 vis., 10 p.t. neutral	22.5

WAX
Mid-Continent

132-134 A.M.P.	6.0

THE most important market changes at the middle of March include a break in gasoline prices on the Gulf Coast and some further softening of Mid-Continent residual-fuel prices.

Rapid reductions in gasoline prices on the Gulf Coast at the end of the second week of March ended with 87-octane regular quoted at 9.5 cents a gallon. Reports indicate that even this price can be shaded on a firm offer. Regular with an octane rating of 83 was quoted at 9.25 cents a gallon.

The trend toward larger proportional increases in sales of premium gasoline has tended to establish a firmer market for these higher-octane motor fuels. The drop in regular prices on the Gulf Coast without corresponding decreases in prices for premium grades has increased the spread in cargo prices for the two gasoline grades.

Since more than half of the gasoline used on the East Coast is shipped from Gulf Coast refineries, a continuation of low cargo prices at Gulf Coast ports will tend to increase the pressure on prices in the high-demand areas of the East Coast. However, some of the pressure on the Gulf Coast market could be relieved through a better distribution of accumulated gasoline inventories.

Total Gulf-East Coast gasoline stocks are up about 9 per cent from last year, but the East Coast is only about 1.2 per cent above last year compared with a gain of about 19 per cent on the Gulf Coast.

A continuation of low prices on the Gulf Coast also can influence the Group 3 price through increased shipments up the Mississippi. Based on the new quotations for the Gulf Coast, a supplier can deliver 87-octane regular at Minneapolis by barge for at least 0.5 cent less than quotations for pipe line delivery of 84-octane.

Group 3 residual prices are off 5 cents a barrel to $1.20, but reports indicate that some refiners are shifting to coking and to production of asphalt and road oils.

CRUDE PRICES
GRAVITY SCHEDULE

	Signal Hill, Calif.*	Oklahoma, Kansas	Gulf Coast Tex.†	West Tex.‡
14-14.9	$1.87			
15-15.9	1.93			
16-16.9	1.99			
17-17.9	2.05			
18-18.9	2.11			
19-19.9	2.18			
20-20.9	2.24	$2.50		$2.37
21-21.9	2.30	2.52		2.39
22-22.9	2.37	2.54		2.41
23-23.9	2.45	2.56		2.43
24-24.9	2.53	2.58	$2.91	2.45
25-25.9	2.61	2.60	2.93	2.47
26-26.9	2.69	2.62	2.95	2.49
27-27.9	2.76	2.64	2.97	2.51
28-28.9	2.83	2.66	2.99	2.53
29-29.9	2.91	2.68	3.01	2.55
30-30.9	2.97	2.70	3.03	2.57
31-31.9	3.04	2.72	3.05	2.59
32-32.9	3.12	2.74	3.07	2.61
33-33.9		2.76	3.09	2.63
34-34.9		2.78	3.11	2.65
35-35.9		2.80	3.13	2.67
36-36.9		2.82	3.15	2.69
37-37.9		2.84	3.17	2.71
38-38.9		2.86	3.19	2.73
39-39.9		2.88	3.21	2.75
40 and above		2.90	3.23	2.77

*Standard Oil Co. of California. †Upper Texas Gulf Coast ‡Includes New Mexico Permian.

Prices East of California effective June 15, 1953. California prices effective February 16, 1953. Pennsylvania Grade prices effective January 1, 1954.

FLAT CRUDE PRICES

Representative posted schedules per barrel

Louisiana:	
Cotton Valley (distillate)	$3.00
Cotton Valley (Holloway crude)	2.95
Texas:	
East Texas	2.90
Chapel Hill	2.83
Conroe	3.13
Van	2.73
Pennsylvania Grade:	
Bradford	3.76
Middle District	3.70
Southwest Pennsylvania	3.31
West Virginia	3.25
Ohio	3.24
Illinois Basin	3.02

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EVERYTHING in new and used equipment for well drilling. Fishing tools rented. Save money, get quotations from Pressey & Son, Pueblo, Colorado.

FOR SALE: Approximately 7900' of 3½" OD Drill Pipe with 5" OD Hughes Flash Weld Tool Joints. Practically new. Lawless Drilling Company, Inc., Odessa, Texas. Phone 6-5982.

FOR SALE: Model 300 Brewster Draw Works, powered with 2—GAK 125 Hp. Compounded. This equipment in drilling service in Cowley County, Kansas. Fortier & Wright Drilling Co., 600 Petroleum Bldg., Wichita, Kansas.

DEMING, MODEL 1809, 5 x 5 "Bulldozer" Pump with air cooled Wisconsin engine. Excellent condition. Sayre-Oman Supply, Box 567, Muskogee, Oklahoma.

WORTHINGTON ENGINE

415 HP, 360 RPM, Model DD 5, 5 cylinder, 4 cycle, Diesel and Gas. 13¼" bore, 17½" stroke. Completely rebuilt and guaranteed.

MANUFACTURERS EQUIPMENT CO.
1078 E. 18 St., Cleveland, Ohio

EQUIPMENT FOR SALE

FOR SALE: Two 18-trace sets of Reflection Seismograph instruments, Rack and Panel mounted. One set mounted in instrument cab, on 1951 GMC Truck, model 301-24. Very reasonably priced. Texas Seismograph Co. Box 2069. Phone 3-1493. Wichita Falls, Texas.

PUMPS FOR SALE at Seminole, Oklahoma; 4 Goulds Figure 1671 Vertical Triplex Pumps, 90, 120 Bbl. per hour, 650# to 800# Pressure, $500 each. Joe A. Huitt, Deep Rock Oil Corporation, Tulsa.

SALES and rentals of cable drilling and fishing tools, casing and equipment, from the Southwest's largest stock of used cable tools and oil field supplies. Degen Pipe and Supply Co., Tulsa, Oklahoma.

FAILING model heavy duty 1500 drill and water truck. Write to Box 819, Longmont, Colorado, for details.

SEVERAL FAILING MODEL 1500 rigs, various ages, conditions and inventories. P. O. Box 643, Billings, Montana.

Gaso Duplex 4½" x 6" Power Pumps with Chrysler C-36 Engines, skid mounted, immediate delivery. Also Byron Jackson, Carter Centrifugal Units. Westinghouse 20-25-50 KW Generating Units.

H. H. COFFIELD
Attn.: W. H. ORR
Phones: 132—Rockdale, Texas
AT-3427—Houston, Texas

EQUIPMENT FOR SALE

250,000 FT. 8⅝ o.d. pipe with collar and plain end. $1.00 per foot Oklahoma. Rogers & Lundquist, 620 Wright Building, Tulsa, Okla. Phone 3-2072—5-8850.

FOR SALE: Small rotary rig mounted on tandem truck. 54 ft. mast derrick type, 2200 ft. of 2⅞ inch I.F.E.U. drill pipe, two (2) mud pumps, dog house, tool box, water tank, oil field truck and trailer. Complete rig ready to work. Good for shallow wells up to 2500 ft. For information P. O. Box 643 or phone 2238, Coleman, Texas.

COMPLETE 3000' Rig, late model machinery. Wilson Super draw works, 7x8½x65 double mast, 145 Waukesha engine, 4x24 ft. sub structure, 4 pipe racks, 6x12 Wilson-Snyder pump with 225 Waukesha motor, 17 in. oil bath table, Brewster swivel block and hook, 38 ft. kelly, Kohler light plant, Steel tool house, 2500 ft. 3½-30 ft. drill pipe, water pump, 2000 ft. water line, Guiberson reverse head with power take off from draw wks. All slips, tongs, hoses and hand tools necessary for operation. Butane and water tanks. Bargain, $20,000. J. A. Finlayson, 108 E. 4th, Ph. 33563, Tyler, Texas.

TWO R.L. CARDWELL DOUBLE-DRUM SPUDDERS with 85-ft., 4-leg masts, one with 185 hp. W.A.K. and other with 145 hp. G.A.K. Waukesha motor. Draw works and motors recently overhauled. Each has 9,000 ft. ¾ in. line and 8,000 ft. ⅝ in. line. Dog houses, small tools. S. R. Lesseig, GA 71932 or P.O. Box 6206, Okla. City, or W. D. Cunningham, 89K4, Alma, Okla.

FOR SALE

9 WORTHINGTON VACUUM PUMPS, Feathervalve, single cylinder, 25" dia. cylinder, 18" stroke.

38 BUFFALO GEAR PUMPS, size 1½" cap. 7½ G.P.M.

27 BUFFALO CO. TURBO FANS, type LL, size 3½" bore, conoidal fans.

37 STORAGE TANKS, 7' x 16', 95 barrel, horizontal, ½" welded tank steel.

9 VACUUM STILLS, 9' x 30' max. press. 60-70 mm., hg. vacuum, max. temp. 660°F., approx. wgt. 36,000 lbs.

12 STEEL BOXES, 8' x 8' x 30', ¼" steel plate.

1 SURGE TANK, 10' x 14'.

3 BAROMETRIC CONDENSERS.

1 HORIZONTAL TANK, 4' x 9'.

1 STEAM SEPARATOR.

1 VACUUM VAPOR CONDENSER.

Prices less than 25% of cost, condition mostly excellent. Located St. Louis District. Material recently dismantled from oil refinery. Many more items too numerous to classify. Write for complete list.

M. E. FITERMAN CO.
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THE PURDY COMPANY
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Chicago, Illinois
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Complete liquidation of Earlsboro Gasoline Plant, handling 10,000,000 cu. ft. daily, sweet gas. Formerly owned by Sunray Oil Corp. In operation until August, 1953.

Prime Movers
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Heat and Power Co., Inc.

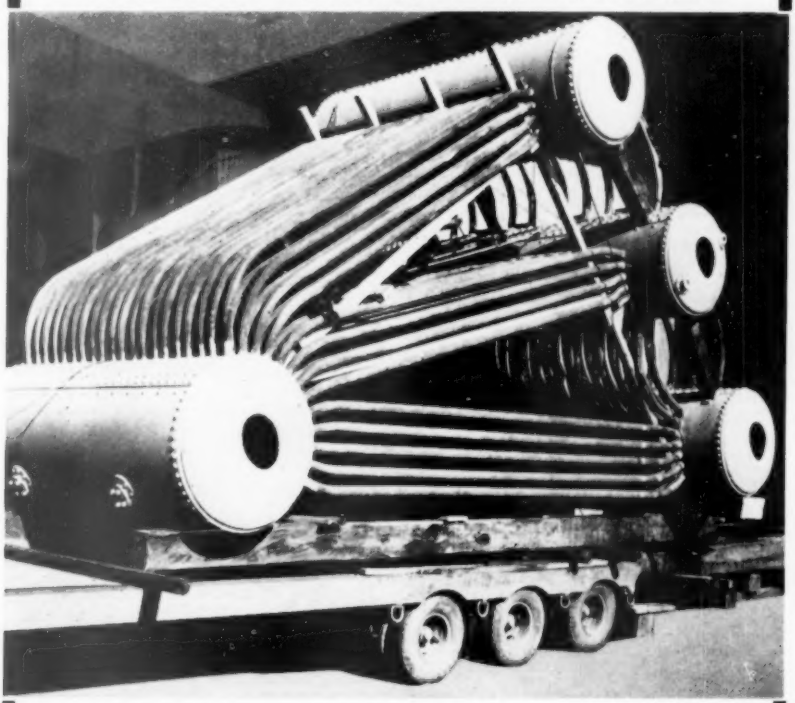
Tulsa, Okla., Thompson Bldg., Phone 3-4890
New York City, 70 Pine Street, Phone Hanover 2-4890

EQUIPMENT FOR SALE

EQUIPMENT FOR SALE

FOR SALE • **24 BOILERS** • FOR SALE

BABCOCK & WILCOX, STIRLING TYPE
ASME CODE — NATIONAL BOARD REGISTERED



16—777 HP (7,777 sq. ft. of heating surface).
8—850 HP (8,500 sq. ft. of heating surface).

All boilers are 4-drum, for 225# operating pressure, equipped with standard superheaters, designed for 128° F. superheat or a total of 525° F. Standard auxiliaries.

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Phone: NEvada 6-2517

40 ea. Cable Tool Stems—4" to 5½" O.D. 20 ea. 5½" x 36' Fishing Jars W. 33¾" Joints 95 ea. Bailers—4¼" to 10" O.D.—25' to 70 Lengths. 84 Sand Pumps—Spang—Larkin—Miller—All Sizes. Well Servicing Units—All Sizes—Truck Mounted or Skid Units. RI. Cardwell Double Drum Spudder—Excellent Condition. General Tool & Supply Co., Box 4387, Oklahoma City, Oklahoma.

EMSCO 300 Rotary Drilling Rig complete with 2 W.A.K. Waukesha Engines compounded; 6,000' 4½" drill pipe, no mast. Now operating in Stephens County, Oklahoma. Box H-104, The Oil and Gas Journal, Tulsa, Oklahoma.

TWO N-K WAUKESHA DRILLING ENGINES. A-1 condition guaranteed. Skid mounted for U-15 draw works. Wallace Engine & Supply. Phone ME 71988, 1915 S.E. 29th, Oklahoma City.

FOR SALE: 1 Wilson Super single drum Swab and Tubing Unit; 10½ x 85 ft. mast; Tools and lines mounted on K7 International Truck, no junk. Phone 6-5684, Odessa, Texas.

FOR SALE: 23,000 ft. new 1" .85# Black T&C Standard Pipe while it lasts at 6c per foot. 15,000 ft. New 6⅝" O.D. 18.97# DRL Electric Weld P.E. Line Pipe, Bev. Large stock used casing and tubing. Box H-105, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE: 10,341 ft. new 2⅜-in. drill tubing, 6.26 lb., J-55, E.U., Pittsburgh Acme, six-thread, with 500 N-80 couplings. Diamond Drilling Co., 2759 East Willow, Long Beach, Calif.

FOR SALE: ENGINE—165 Hp. Climax T-61 on Skid. Herndon Drilling Company, 421 Mayo Building, Tulsa, Phone 4-9700.

EQUIPMENT WANTED

WANTED: Complete Rotary Rig, U 15 or National 50 Class, preferably located in West Texas. Box H-106, The Oil and Gas Journal, Tulsa, Oklahoma.

NOTICE: We buy, We sell equipment everywhere. If you want to sell or buy contact Pressey & Son, Pueblo, Colorado.

WILL PAY highest prices for used casing, used line pipe, abandoned leases, or other surplus lease equipment. Your idle producing equipment is worth dollars. Green Pipe & Supply Co., Box 1383, Tulsa, Oklahoma.

WANTED: Either Walker-Neer, Model 310 or Bucyrus No. 48, with or without tools. Supply complete information first wire or air mail. Sioux Drilling Company, 503 Seventh Street, Rapid City, S. D.

WANTED: Used 5 x 8 horizontal, single action, Triplex power pump. Please state make and condition. Acid Engineers, Inc., Lakin, Kansas.

WANTED: A complete up-to-date Rotary Drilling Rig with portable mast, but less drill pipe, capable of drilling to 5000 ft. with 4½" pipe. Write giving all details, location and price. Box G-995, The Oil and Gas Journal, Tulsa, Oklahoma.

HELP WANTED

WANTED, GAS ENGINEER, must have college degree and at least 7 years experience gas and oil production, treating and transmission. Independent Producer, East Texas. Box H-118, The Oil and Gas Journal, Tulsa, Oklahoma.

PHOTOGEOLOGIST—To head photogeolic interpretation section. Must be College graduate—5 years experience—mining experience desirable. Write giving age, education, and full details of experience. All replies confidential. Box G-968, The Oil and Gas Journal, Tulsa, Oklahoma.

OIL SECRETARY: Age 35 to 50, for independent oil company in Okla. City. Must be expert Stenographer, well experienced in oil production and operations. Excellent salary with raises commensurate with ability. Give references. P. O. Box 1824, Oklahoma City, Oklahoma.

ENGINEER with structural experience and some knowledge of drilling equipment or methods desired by recognized oil field equipment company for contact work and sale of derricks and all related drilling structures. Box G-990, The Oil and Gas Journal, Tulsa, Oklahoma.

EXECUTIVE MANAGER

Independent production firm in Oklahoma desires experienced manager to act in capacity of president of company. Must be experienced executive in all phases of petroleum industry — others need not apply. Salary commensurate with ability and position. Complete information in application should include age, marital status, detailed experience and education.

Box G-984
The Oil and Gas Journal
Tulsa, Oklahoma

Party Chief and Seismologist

Newly formed geophysical organization of major oil company needs experienced party chief. Also needs record interpreter with minimum of 2½ years experience and 6 months record picking.

Our employees know of this ad.

Box G-987

The Oil and Gas Journal
Tulsa, Oklahoma

OVERSEAS POSITION GEOLOGIST

Roving overseas assignment with Standard Oil Company (New Jersey) available for qualified geologist. Will consider geologist with B.S. or M.S. degree, inexperienced recent graduate to several years professional experience. Age 21-28, unmarried.

Will be required to assist in reconnaissance geological surveys to evaluate areas of interest. Position available immediately.

Write giving details of personal data, education and experience.

Box 308-P

RADIO CITY STATION
New York 19, N. Y.

HELP WANTED

LANDMAN-GEOLOGIST
Independent oil company has opening around April 1st for combination geologist and landman. Must be experienced and thoroughly familiar with Julesburg Basin and have general knowledge of Rocky Mountains. Good position for right person. In applying, give past employment record, educational background, and age. All replies strictly confidential. Box H-116, The Oil and Gas Journal, Tulsa, Oklahoma.

OIL INDUSTRY Employment Service, **Tom Robinson**, owner, 405 Tuloma Bldg., **Tulsa, Oklahoma. For technical and trained oil industry personnel.** Write for blank.

EXPANDING independent oil company has immediate openings for following positions. Give age, employment record, educational background. Replies strictly confidential. For Houston Office: Petroleum Engineer with geological background. Experience in overall production operations including completions and experienced draftsman. For Wichita Falls Office: Experienced Geologist for position District Geologist, North Central Texas; an experienced subsurface geologist. For Denver Office: District Geologist experienced and thoroughly familiar with Julesburg basin and general knowledge of Rocky Mountain Area. Box H-107, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST
Independent oil company has opening around April 1 in Tulsa office for geologist with major company training in Mid-Continent Area. Male or Female. Must be good draftsman and have ability to do contour mapping and preliminary lease evaluations. In replying give past employment record, educational background, and age. All replies strictly confidential. Box G-997, The Oil and Gas Journal, Tulsa, Oklahoma.

FOREIGN EMPLOYMENT. List of oil companies and drilling contractors showing where to apply for foreign jobs. OIML Co., Box 2603, Tulsa, Okla. $5.00 cash.

EXPERIENCED OPERATORS & MAINTENANCE MEN for new small refinery being completed March 1954. Texas MEK dewilling process. Send statement of qualifications to P.O. Box 863, Salt Lake City, Utah.

GEOLOGIST-LANDMAN
Independent oil company has opening around April 1st for combination geologist and landman. Must be capable and thoroughly familiar with West Texas and New Mexico. Good position for right person. In applying, give past employment record, educational background, and age. All replies strictly confidential. Box H-117, The Oil and Gas Journal, Tulsa, Oklahoma.

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FIELD & OFFICE STAFF
—OILMEN CONSULT—
GOOD EMPLOYMENT AGENCY
Skilled free service by technicians.
1554 California St. **AC. 0835**
Denver, Colorado **(24-hr. service)**

SITUATIONS WANTED

GEOLOGIST: 31, married. B.S. Degree Texas A & M College, 5 years' experience in Gulf Coast and Venezuela. Exploration, exploiting, reservoir and regional studies, reserve estimates and administrative background. Foreign or domestic operations. Box G-994, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED IN CANADA

EXPERIENCED MAUFACTURER REPRESENTATIVE IN CANADA DESIRES ADDITIONAL ACCOUNTS. MANUFACTURERS NOW REPRESENTED INCLUDE GRAY TOOL CO. AND VENTURA TOOL CO. BEST OF REFERENCES.

LEIDECKER TOOL CO. LTD.
6921 104TH STREET
EDMONTON, ALBERTA CANADA
PHONE 35016

SITUATIONS WANTED

EXPERIENCED drilling, completion, production superintendent available for progressive organization. Engineering graduate, 7½ years major company experience. Age 37, married. Box H-112, The Oil and Gas Journal, Tulsa, Oklahoma.

PRODUCTION AND DRILLING SUPERINTENDENT with 25 years experience desires position with independent company. Sober and reliable and now employed. Box H-109, The Oil and Gas Journal, Tulsa, Oklahoma.

CABLE TOOL MANAGER, experienced in all phases of drilling; supervisor, purchasing. 27 years in the drilling industry. Prefer employment with major firm. Box H-111, The Oil and Gas Journal, Tulsa, Okla.

NATURAL GAS & PETROLEUM ENGINEER, 29, six years varied experience in production, completions, reserves, unitization, repressuring, cycling & plant operation. Desire connection with independent or consultants. Box H-115, The Oil and Gas Journal, Tulsa, Oklahoma.

GRADUATE Petroleum Production Engineer, twelve years major company experience in oil and gas production. Interested in connection with independent. Will consider part-time employment on retainer basis if location within 100 mile radius Norman, Oklahoma. Details of experience and references given on personal interview. Reply to P. O. Box 68, Oklahoma City, Oklahoma, attention Mr. Wingo.

ATTENTION: Well established oil well drilling contractor desires to manage and supervise: Individuals', groups', small or medium-sized oil companies' drilling, production and operating problems in Central and Western Texas and New Mexico. Personal interview by appointment is desired. Makin Drilling Company, Box No 1618 Ph. **No. 3-3141, Hobbs, New Mexico**

GEOPHYSICIST: Seven years seismograph experience, age 30, family. Box G-986, The Oil and Gas Journal, Tulsa, Oklahoma.

MECHANICAL ENGINEER, 31, married, 4 years supervisory experience with pipe line company; 3 years in field supervising construction. Desires immediate employment. References and complete resume upon request. Box G-985, The Oil and Gas Journal, Tulsa, Oklahoma.

SUPERINTENDENT: College graduate, now employed as district superintendent. 17 years varied experience in engineering, drilling, and production, with major. Desire position with smaller company or independent. Box H-110, The Oil and Gas Journal, Tulsa, Oklahoma.

AVAILABLE: 25 years experience purchasing agent and warehouse superintendent experience Middle East, South America and Canada. Refinery and pipe-line work preferred. Box H-103, The Oil and Gas Journal, Tulsa, Oklahoma.

Experienced oil company manager desires position with independent group. Technically trained, under 40, experienced in all phases of exploration and development of oil and gas properties. This includes unitization, plants, pipe lines, financing. Presently employed as manager. Box H-108, The Oil and Gas Journal, Tulsa, Oklahoma.

Excellent opportunity for operator or group, seeking geologist to represent them in Central and West Texas. Thoroughly competent and experienced geologist available for headquarters in Abilene, Texas. Investigation and references excellent. Price's Oil Executive Personnel Agency, 239 White Building, Abilene, Texas.

MANUFACTURERS' REPRESENTATIVE

Covering Southern Oklahoma and North Central Texas, desires additional accounts in oilfield production and drilling equipment. Reply—
Box H-101
The Oil and Gas Journal
Tulsa, Oklahoma

ROYALTIES

OIL ROYALTY FOR SALE: 1/32 undivided interest in 3200 acres. Producing well within one mile of east line Cheyenne County, Nebraska. Price $2500.00. P. O. Box 216, Sidney, Nebraska.

OFFERING CHOICE ROYALTIES on geology in Oklahoma's greatest oil fields. A. S. Berry, 522 Wright Bldg., Phone 5-5402 Tulsa, Oklahoma.

LEASE AND DRILLING BLOCKS

WANTED: Small blocks, oil, gas leases, for secondary recovery. Box G-954, The Oil and Gas Journal, Tulsa, Oklahoma.

ATTRACTIVE OIL & GAS LEASE in Southeastern New Mexico. 120 acre State lease—1961 expiration—includes SW/4 NW/4 Sec. 36-6S-30E Chaves Co., SW/4 NW/4 Sec. 27-6S-34E Roosevelt Co., NW/4 SW/4 Sec. 26-19S-27E Eddy Co. First reasonable offer accepted. Box H-113, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE: 320 acres, small Hunton well, Nemaha County, Kansas. Thousand acres offset leases. Sell or farm out cheap. R. D. Swan, Daniel Bldg., Tulsa.

FOR SALE: Attractive surface structures in Overton County, Tenn. Seven sands above 1600 feet. Seven rigs drilling in adjoining county. N. M. Sauls, Geologist, Cookeville, Tenn.

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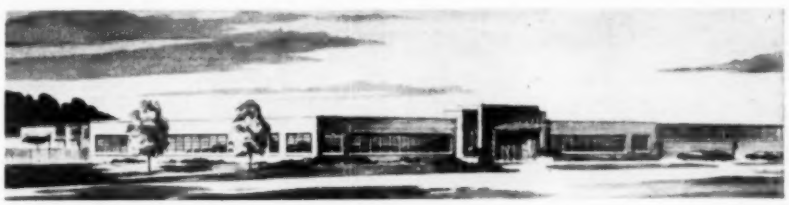

New Plant for Metallizing Engineering

Plans for a new plant at Westbury, L. I., N. Y., were recently announced by Metallizing Engineering Co., Inc. The new building is scheduled for completion July 31, 1954, and will occupy 65,000 sq. ft. of a 7-acre tract. It will include over 20,000 sq. ft. of office space in addition to 45,000 sq. ft. of manufacturing, storage, and shipping areas, all located on a single floor. The building will be constructed of brick, masonry, steel, and glass. The metallizing, which of course is well known in industry, involves the use of a metal spray gun through which a wire is drawn, melted at the gun nozzle in an acetylene flame, and sprayed with a stream of compressed air.

Flotation Co. Offers New Maintenance Service

Inspection, repair, and maintenance service for water-sealed gas holders is now offered by The Flotation Co., Inc., Elizabeth, N. J., it has been announced by E. R. English, vice president.

Availability of these services, together with the painting of holders by the flotation method, makes it possible for owners of gas holders to place responsibility for all phases of holder work in one organization.

Arthur C. Loveny, who is highly qualified, has been appointed to handle the new service.

Eskridge, Youngs Head New Hydraulic Drives Company

Hydra-Drives, Inc., has been formed in Tulsa for the sales and service of torque converters to the oil industry in the Mid-Continent area. The company will specialize in the converting of existing equipment from straight mechanical drive to hydraulic drive for greater operating efficiency, and the sale of hydraulic drives for new equipment.

W. A. Eskridge, vice president, will be in charge of industrial sales, and P. R. Youngs III, vice president, will be in charge of automotive sales.

Hydra-Drives, Inc., has been appointed sales and service representatives for Schneider Manufacturing Corp. and Torcon Corp., both manufacturers of torque converters.

Both Eskridge and Youngs have had long experience in the field of hydraulics. Eskridge, prior to the formation of Hydra-Drives, was vice president of Service Engineering Co., and before that, he was dealer and service manager for Twin Disc Clutch Co.

Youngs was for many years associated with Schneider Manufacturing Corp. in a sales capacity. Last year he represented both Schneider and Torcon as regional sales representative.

Instruments, Inc., Buys Telematic Rights

O. W. Graham, president of Instruments, Inc., gage and instrument manufacturers, Tulsa, has announced the purchase of all patents, dies, fixtures, materials, and trade marks of Telematic Corp., Chicago. Telematic gages provide accurate remote reading of liquid levels in tanks.

Manufacture, sales, and service of the gage will be handled by Instruments, Inc., or their authorized sales representatives. Replacement parts for gages now in service will be available through the company's headquarters in Tulsa.

Stropp to Head Emjay's Southwestern Division

Edward Stropp, formerly of Short Hills, N. J., has been assigned to the new Houston branch office of Emjay Maintenance Engineers as vice president in charge of the southwestern division. Prior to this appointment, Stropp served in an administrative role at the main office in Rutherford, N. J.

Stropp will assist local industrial maintenance supervisors in the planning and implementing of protective

coating operations. His extensive background and training will be applied in helping plant engineers cope with waterproofing and corrosionproofing problems eencountered in modern processing industries.

Daniel Orifice Fitting Elects New Officers

Daniel Orifice Fitting Co., of Los Angeles and Houston, has just announced the election of its new officers. Paul P. Daniel will remain as chairman of the board, but has relinquished the presidency of the company to permit him to devote a greater portion of his time to the expansion of the company's activities.

Joseph G. Holdenried, formerly vice president and general manager, succeeds Paul Daniel as president. Other officers include the reelection of William Griffin, Jr., as vice president, Alphonsine Ring retains her former position as secretary-treasurer, and L. Waldo Wilbern as director. Kathleen Haney was elected assistant secretary.

McClure Appointed Head of Carbide & Carbon Chemical

Harry B. McClure has been appointed president of Carbide & Carbon Chemicals Co., a division of Union Carbide & Carbon Corp., it has been announced by Morse G. Dial, president of the corporation.

McClure succeeds Dr. J. G. Davidson, who becomes chairman of Carbide & Carbon and a member of the appropriations committee of Union Carbide. Dr. Davidson is also a vice president of Union Carbide & Carbon.

Heat & Power Co. Opens Tulsa Office

Heat & Power Co., Inc., New York City, has opened a regional office in the Thompson Building, Tulsa. Kenneth A. Kallemeyer will be in charge, according to announcement by Karl Strassman, president.

The firm has taken over the Earlsboro gasoline plant, which was formerly operated by Sunray Oil Corp., and now offer it for sale, either complete or in parcel. The Earlsboro plant was a Tulsa-type, absorption, 10,000,0000-cu. ft. plant, handling sweet gas.

Harrington Made Blaw-Knox District Sales Engineer

Horrall Harrington has been appointed sales engineer for the Midwest district by Blaw-Knox Co., Chemical Plants Division. Harrington will be located at the Chicago office, and will offer the processes and engineering-construction services of the company to chemical and industrial clients in a 12-state area.

Prior to his present assignment, Harrington held engineering positions in Chemical Plants Division over a 7-year period, and had earlier employment with American Bridge Co., Carnegie-Illinois Steel Corp., and H. K. Ferguson Co.

Detroit Diesel Official Returns From Mexico City

Arch Campbell, manager, petroleum industry sales for Detroit Diesel Division, General Motors Corp., has just returned to his headquarters in Tulsa, from a visit to Mexico City, Mexico.

While in Mexico City, Campbell attended meetings of the American Society of Mechanical Engineers held March 10 through 12. He also visited the General Motors plant and talked with Pemex officials in Mexico City.

Reed Names Atkisson As Division Field Engineer

Edward E. Atkisson has been named division field engineer for Reed Roller Bit Co., and is now responsible for company field-engineering activities in the North Central area, it has been announced by W. B. Noble, vice president in charge of engineering. He has been with Reed's product-engineering department since he joined the firm.

The appointment of Glen Scott as a new division field engineer in the Rocky Mountain area was announced at the same time. Scott is a graduate of University of Houston school of mechanical engineering. He will assume responsibility for Reed field engineering activities in the area of Northern New Mexico, Colorado, Wyoming, Montana, the Dakotas, and Nebraska.

Sargent Executives Discuss Expansion

Acceptance of Sargent Engineering Corp. establishment of field stores is reflected in the smiles of these executives meeting in Los Angeles. Front row: Haskel F. Wright, Tulsa; Verdi E. Boyer, southern district of California; Louis H. Baher, California sales manager. Back row: George L. Sargent, treasurer and general sales manager; J. H. Parker, Huntington Park; H. L. Sargent, assistant general sales manager; J. A. Laffin, northern district California; O. H. Leichliter, Mid-Continent sales manager.

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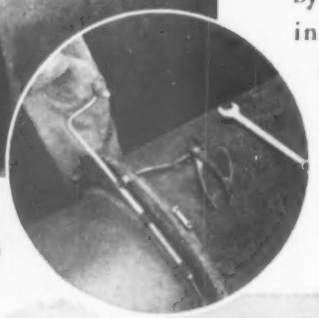

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